IRRIGATION WITH SEWAGE AND URBAN HOUSEHOLD EFFLUENT

IRRIGATION PAR LES EFFLUENTS URBAINS DOMESTIQUES

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ABSTRACT

One of the important factors that limit agricultural development and sustainability of fariab (irrigated) lands is the lack of adequate fresh water. In this condition, one may use poor quality domestic or sewage effluent, after suitable treatment or by mixing it with fresh water so that the quality of the mixed water is of permissible standard for irrigation. In using sewage water, there is little information on the effect of its long-term use on soil properties and on the agricultural produce. In estimating the quality of well water and filtered sewage water and for judging its suitability for irrigation, the published standards of the Food and Agriculture Organization (FAO) have been used. Sewage effluent contains nutrients that are useful for the plants in increasing their productivity. The sewage has about 21% organic matter, which has an effect on soil physical and chemical and hence on growth and performance of plant. Land irrigated by well water showed higher nitrogen content in the soil at the beginning of the plant growth stage but towards the final stages of the plant growth, the nitrogen content in the soil was higher when the land was irrigated by sewage effluent.

Key words: *Sewage irrigation, Sewage nutrients, Water treatment, Well water.*

RESUME

L'un des facteurs importants qui limitent le développement agricole et la durabilité des terres irriguées (Fariab) est le manque d'eau douce adéquate. Dans cette condition, on peut utiliser l'eau de mauvaise qualité ou d'effluents domestiques, après le traitement approprié ou en mélangeant l'eau fraîche afin que la qualité de l'eau mélangée soit acceptable à l'irrigation. Il existe très peu d'information sur l'effet à long terme des usages d'effluents sur les propriétés du sol et les produits agricoles. On utilise les normes établies par l'Organisation des Nations Unies pour l'Alimentation et l'Agriculture (FAO) dans l'évaluation de la qualité des eaux de puits et des eaux traitées d'effluent, et de sa pertinence pour l'agriculture.

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Les effluents contiennent des nutriments qui sont utiles pour accroître la productivité des plantes. Ils contiennent également 21% de matière organique qui exerce un impact sur les propriétés physiques et chimique du sol et donc sur la croissance et la performance des plantes. Au début, lors de l'étape de la croissance des plantes, la terre irriguée par l'eau de puits a montré une plus forte teneur en azote du sol, mais vers les étapes finales de la croissance des plantes, la teneur en azote du sol était plus élevée lorsque la terre était irriguée par les effluents.

Mots clés : *Irrigation par effluents, nutriments des effluents, traitement de l'eau, eau de puits.*

1. INTRODUCTION

Waste water is generated from human daily use of fresh water (Agricultural & urban). Waste water is a combination of 99% water and 1% solids (Hoseinian, 1996). Japan has, shown an increasing rate of waste water recycling project for irrigation nowadays (13 Mm^3/year recycling). It is practiced in Morocco, Jordan, Saudi Arabia, Pakistan, Oman, Emirates & Palestine (Tavakoli &Tabaei, 2009). Most of the countries like Germany, England, Japan and recently Iran reuse waste water after filtering. Water deficit is an important limitation for irrigated lands development, and low quality or unconventional water could be used for it (Baharemand et al., 2002, Bahari 1999, Cheni et al., 2001). Vraban waste water with a combination of organic matter, minerals and gases is a poor quality water. Physical and chemical nature of this water requires specific management to make it usable for agriculture (Ferigin et al., 1991). There isn't enough information about effects of long term uses of waste water.

Sewage has many nutrition elements which are usable by plants to increase yield (Alizade, 1995). Also effluent sludge has so much micro elements and heavy metals content which are absorbable by plant when these are added to soil. Food pollution occurs by heavy metal and micronutrients absorption. There are some laws to prevent high rate of heavy metal and micro elements application to crop land in different countries. The World Health Organization has also set guidelines on the permissible quality of irrigation and potable water in terms of the concentration of various elements (Sing & Stines, 1994). Fertilizer contamination through waste water use is important because soil rehabilitation and fertilization costs are the major expenses of famers (Tavakoli & Tabataei 1999, Shariati, 1996). Phosphorous is one of the most important factors effective on bacteria and plants feeding after nitrogen in waste water. Both mineral and organic phosphorous (orthophosphate and polyphosphate) are two well-known components found in waste water. Phosphorus concentration average at household waste water is about 10 mg/lit. Phosphorus in waste water comes from sludge with a range of 30-50 % and the remaining content comes from detergents used in home and restaurants. The average per person phosphorous is estimated 500 mg/y and its yearly average by detergents uses is about 100 g per person (Alizade 1995)

Chemical specification of effluent

Some chemical specifications like salinity, alkalinity and concentrations of micro and macronutrient elements, as well as of heavy metals were measured to study sewage quality for planting.

Elements concentration on plants

Sludge and sewage could play an important role to supplement nitrogen for plants. The nutrient elements like phosphorus, calcium, magnesium and potassium concentration in sewage is considerable and they are within the standard range for irrigation, as prescribed by the Department of Environment, Iran.

Chemical specification of sludge

Sludge includes 21% of organic matter with a desirable effect on physico-chemical characteristics of soil and finally on growth and yield of plants (Saber 1986).

2. ELEMENTS CONCENTRATIONS ON PLANTS

Nitrogen. The liquid and the sludge of waste water could play valuable role on Nitrogen supplementation for plants because of different shape of nitrogen specially organic N present in them. At least half of nitrogen content of sludge and sewage is in the form of organic N, which is delivered to plant after gradual change to the mineral (plant available) form of it. Gradual releasing of nitrogen causes less wasting of this element, it make sludge and effluent applying more important. Generally sludge and effluent causes increasing nitrogen content of plants (Safari Sanjjani 1995; Alizade 1996).

Phosphorus. The study of 3 plants has not shown significant difference in total phosphorus concentration at arial organelles of plants. Phosphorus concentration in wheat and barley is at more than critical level at all treatments and it is lower in corn plants irrigated by effluent and filtered effluent mixed river water. Constant level of phosphors in plants reflects that a high level of this in soil due to irrigation by effluent & sludge is either dissipated or not taken up by the plants (Malakuti et al. 1994).

Sodium. Different levels of effluent & sludge have raised Sodium concentration level at plant in comparison to the wells water. This raising is higher at plants irrigated by over flow filtration effluent and river charged effluent. (Malakuti & Nafisi 1993 Vakili 1995)

Well water and waste water quality

Based on irrigation water quality standard, wells water has no limitation to use for irrigation but filtered sewage quality shows electrical conductivity higher than allowed level which causes salinity stress to the plants and toxicity of salt-sensitive plants. In the case of wheat, threshold salinity for maximum potential production is 4.5 dS m^{-1} (Afyuni et al., 1997). Considering sewage salinity which is lower than critical level, and soil texture (loamy sandy), the soil salinity and yield decreasing could be controlled by Irrigation management (Barzgar, 2000).

Irrigation water treatment effect on soil total nitrogen: The total measured nitrogen in 2 treatments: well water and effluent water, showed higher N amount in soil irrigated by effluent where as it was reverse in the end of growing season. The total nitrogen increasing at the end of growing season caused by transporting nutrient elements like nitrogen, phosphorus and potassium to the soil. The high range of nitrogen at none case showed adverse effect on products and plants (Petty grove and Asano, 1990).

Irrigation by effluent and its effect on soil nitrogen

It is observed that total soil nitrogen content was decreased during the growing season in sprinkler irrigated area using well water. It was opposite and significant change occurred while using effluent for irrigation. It could be concluded that sprinkler irrigation system in comparison to surface irrigation results in lower total soil nitrogen. The comparison of soil total nitrogen during a growing season revealed that irrigation by effluent has a positive impact on soil total nitrogen (Valinezdad et al., 2002).

Soil leaching by effluent

Effluent causes cation exchange in soil and due to this, soluble cation of soil solution and exchanged, and cation washes out to the drainage water. Sodium ion exchanges with soil cations, especially calcium and magnesium and these exchanged ions wash out of soil equilibrium solution. This decreasing process continues to make equilibrium between exchangeable cations and soil solution. After that drainage water sodium cation content increases to an equilibrium between soil solution and drainage water (Zha and Alva. 1993).

3. CONCLUSIONS

Sodium percentage, electrical conductivity and soil PH changes were shown while leaching by effluent.

Average exchangeable sodium percentage during an experiment by adding 2230 ml effluent to soil changed from 24.4% to 28.1% from the first to the last stage of plant growth (Singh et al 1997).

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