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Waste water use in Agriculture: Barriers and facilitators

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ABSTRACT

Wastewater has various benefits to the agricultural sector but its direct and indirect use is associated with several health hazards. Wastewater contains pathogenic organisms similar to those in excreta in human beings which cause different types of diseases like cholera, typhoid, paratyphoid. Many of these are capable of survival in the environment in crops or in the soil, and pose health risks to farmers and their families, consumers, and nearby communities. However, in order to maximize opportunities and minimize risks related to the use of wastewater in agriculture, a vigorous strategy and institutional framework has to be planned. Stakeholders and important authorities within public institutions have to work in synergy to come up with a robust strategy. Due to increasingly widespread usage and potentially deleterious effects of unmanaged wastewater irrigation, it is important to know about safe use of wastewater irrigation especially with respect to human health and overall agriculture ecosystem. This paper concluded that the incorporation of wastewater use planning into national water resource and agricultural planning is imperative especially during the phase of water stress. This is not only to protect sources of high quality waters but also to minimize wastewater treatment costs, safeguard public health and to obtain the maximum agricultural and aquacultural benefit from the nutrients that wastewater contains.

Keywords: Waste water use in Agriculture: Barriers and facilitators

INTRODUCTION

Contemporary global water demand has been estimated at about 4,600 km3 per year and projected to increase by 20–30 % to between 5,500 and 6,000km3 per year by 2050 [1-3]. It is being projected that water demand is going to be as high as 24% by 2025 and 74% by 2050 to present level. This is putting current agricultural and irrigation practices under severe pressure. Therefore, to shorten the gap between the supply and demand for water, an archetype is now required over the world not only to prevent further damage to sensitive ecosystems and the aquatic environment, but also to emphasize that wastewater is also a resource and accordingly should be used for the benefit of effective crop production and to tackle future water security [4-5]. Therefore, wastewater is one such potential source which, if used safely can help in resolving to some extent the scarcity of water problem, meanwhile people can be able to manage also this voluminous volume of water which at present is considered as only waste. Wastewater is defined as "a combination of one or more of domestic effluent consisting of black-water (excreta, urine and faecal sludge) and grey water (kitchen and bathing wastewater); water from commercial institutions, including hospitals; industrial effluent, storm-water, other urban run-off; agricultural, horticultural and aquaculture effluent, either dissolved or as suspended matter".

Categories of Wastewater

Generally, wastewater is of two types i.e.; municipal wastewater and domestic wastewater. Municipal wastewater consists of domestic wastewater, industrial wastewater, stormwater, and by groundwater seepage entering the municipal sewage network. On the other hand, domestic wastewater consists of effluent discharges from households, institutions, and commercial buildings. In some developed cities where there are separate systems, the municipal sewage network also serves as the storm water sewer.

Table 1

Constituents	Concentration in mg/l		
	Strong	Medium	weak
Total solids	1200	700	350
Dissolved solids (TDS)[1]	850	500	250
Suspended solids	350	200	100
Nitrogen (as N)	85	40	20
Phosphorus (as P)	20	10	6
Chloride[1]	100	50	30
Alkalinity (as $CaCO^3$)	200	100	50
Grease	150	100	50
$BOD^5{}_2$	300	200	10

Features of Wastewater

Wastewater characteristics differ from region to region, but a general idea about its constituents are presented in the table Table 1 above.

Wastewater which is used for land irrigation covers different qualities of wastewater, ranging from raw and diluted, generated by activities of various urban areas [5-6]:

1. Urban wastewater is usually a combination of one or more of the following:
- Domestic effluent consisting of black water (excreta, urine and associated sludge) and grey water (kitchen and bathroom wastewater).
- Effluent from commercial establishments and institutions, including hospitals.
- Industrial effluent where present.
- Storm water and other urban run-off
2. Treated wastewater is wastewater that has been processed through a wastewater treatment plant and that has been subjected to one or more physical, chemical, and biological processes to reduce its pollution of health hazard.
3. Reclaimed (waste) water or recycled water is treated wastewater that can officially be used under controlled conditions for beneficial purposes, such as irrigation. Grey water is particularly suitable for reuse. Grey water is generated from households not connected to sewerage system and can be treated and used for irrigation of home gardens and trees such as olives, palm tree and mostly non-edible trees. Grey water is an important component of water conservation and comprises 50-80% of residential wastewater and offers a great potential as an economic and resource conservation component of the integrated water resources management in dry areas.

Urban Wastewater Use in Agriculture

The use of urban wastewater in agriculture is centuries-old practice that is receiving renewed attention with the increasing scarcity of freshwater resources in many arid and semi-arid places. Driven by rapid urbanisation, water stress in parts due to climate change and growing wastewater volumes, wastewater is widely used as cost effective alternative to conventional irrigation water. Various attempts are made to categorise the wastewater reclamations and use in agriculture [6-8]..

Direct use of treated (or reclaimed) wastewater is the use of reclaimed water that has been transported from the point of treatment or production to the point of use without an intervening discharge to surface water or groundwater body. Direct use of untreated wastewater is the use of raw wastewater from a sewage outlet, directly disposed of on land where it is used for crop production. Indirect use of untreated wastewater is the abstraction of usually diluted wastewater (or polluted stream water) for irrigation. This is common downstream of urban centers where treatment plants are limited. Farmers might or might not be aware of the water quality challenge.

Planned wastewater use is the conscious and controlled use of wastewater either undiluted (direct) or diluted (indirect). Most use of untreated wastewater is unplanned and indirect. Within the category of planned wastewater use for irrigation, two subcategories are important:

(a) Restricted irrigation is the controlled use of wastewater to grow crops that are not eaten raw by humans; and

(b) Unrestricted irrigation is the controlled use of treated wastewater to grow crops that are normally eaten raw.

BENEFITS OF WASTEWATER USE

The most important factor which makes wastewater valuable is that it is reliable source of water and available all year round and it also contains large diversity of nutrients than any commercial fertilizer can provide which in turn permits higher crop yield, year-round production, and increases the range of crops that can be irrigated. It also makes possible more secure and higher urban agricultural production and contribution to food security which leads to higher income and employment generation in urban areas and improve livelihoods for urban agriculturalists.

The land application of wastewater for agricultural use constitutes a low-cost disposal method and a land treatment system. If carried out under controlled conditions can also recharge aquifers through infiltration but it must be done under strict regulation. Reduced costs to society are also notable, in view of reducing the fossil fuel in fertilizer production [6-8].

LIMITATIONS OF WASTEWATER USE

The use of wastewater shows various benefits in agricultural sector but its direct and indirect use is associated with several health hazards. The health hazards associated with it are of two types i.e., the rural health and the safety problems for those working or living near the site of operation. Wastewater contains pathogenic organisms (viruses, bacteria, protozoa and helminthes) similar to those in excreta in human beings which cause different types of diseases like cholera, typhoid, paratyphoid etc. [4-6].

Many of these are capable of survival in the environment in crops or in the soil, and pose health risks to farmers and their families, consumers, and nearby communities. Other contaminants present in untreated water that can pose serious health and environmental risks are chemical agents, salts and heavy metals (e.g. cadmium, chromium, copper, mercury, nickel, lead and zinc) [3-4]. Managing these risks is a crucial issue that must be addressed from local and global perspectives.

Water quality guidelines for maximum crop production

Irrigation water is categorized into various quality classes in order to guide the user to the potential advantages as well as problems associated with its use and to achieve optimum crop production. The water quality classifications are only indicative guidelines and their application will have to be adjusted to conditions that prevail in the field. This is so because the conditions of water use in irrigation are very complex and difficult to determine.

CONCLUSION

In order to maximize opportunities and minimize risks related to the use of wastewater in agriculture, a vigorous strategy and institutional framework has to be planned. In many countries where wastewater is used for agriculture, these frameworks are lacking. Stakeholders and important authorities within public institutions (health, agriculture and water) have to work in synergy to come up with a robust strategy. Due to increasingly widespread usage and potentially deleterious effects of unmanaged wastewater irrigation it is important to know about safe use of wastewater irrigation especially with respect to human health and overall agriculture ecosystem. The incorporation of wastewater use planning into national water resource and agricultural planning is imperative especially during the phase of water stress. This is not only to protect sources of high quality waters but also to minimize wastewater treatment costs, safeguard public health and to obtain the maximum agricultural and aquacultural benefit from the nutrients that wastewater contains.

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