26th WEDC Conference Dhaka, Bangladesh, 2000

WATER, SANITATION AND HYGIENE: CHALLENGES OF THE MILLENNIUM

The effects of wastewater irrigation in Kitwe, Zambia

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THE CONCEPT OF using sewage effluent for agricultural production started more than 2000 years ago when crops in Greece were irrigated with such effluent (Pesco and Arar, 1988). While in China the practice has been prevalent for centuries. However, in Zambia, the practice started as soon as conventional sewage works became operational as pointed out by some of the civic workers in the sewage plants. In addition, the effluent was used to irrigate gardens established around the outfalls. All these approaches were meant to boost agricultural production resulting from abundant water and nutrients. The presence of these factors in soil sustains the plant growth and hence generates farmer's incomes.

Objective(s)

The principle objective for carrying out this research was to encourage the Kitwe City Council to institute and effectively implement the necessary bye-law(s) that conform to the "recycling of the wastewater in line with human health."

General about the study area

Kitwe is the second largest city in Zambia after Lusaka, which is the capital city of the country. It is located on longitude 280 07' E and latitude 120 54' S (Chikuma et al, 1991). Like any other town in the country, Kitwe experiences a short wet season and a long dry season (Lambert and Faulkner, 1991). On the average, annual rainfall increases from 200 mm per year in the south to over 1000 mm per year in the north of the country during the normal rainfall year.

The need to use wastewater for irrigation

One of the major constraints on crop production in Zambia is the availability of water. Until recently, Zambia has been hit by a series of draughts. According to statistics, the Department of Meteorology pointed out that Zambia registered annual rainfall of below 250 mm for over 2 to 3 years before 1996 in many parts of the country (Nkomoki, 1996). Akayombokwa, (1988) observes that drought had occurred in Zambia in the 50's, 60's, and 80's.The occurrence of such events continued into the 90's (Mtonga,1994) Therefore, dependence on rainfall only in Zambia may not boost agricultural growth to desirable levels. In view of the afore-going, increased water demands has meant that reuse of wastewater has become an important consideration in Kitwe. This undoubtedly has forced the small communities of the peri-urban areas of Kitwe to resolt to the use of wastewater to irrigate gardens.

Table I demonstrates that there are many examples in the world where reuse of wastewater for agriculture is practiced and crop production is boosted. It further shows that lower yields are experienced despite adding fertilizers to fresh water which is used for irrigation.

Methodology

The study utilized communities in the study area of Ndeke and Mulenga township whose primary source of income came from "the cultivation of plots under wastewater irrigation." In preliminary studies, questionnaires were circulated but the community responded negatively to this move. Family groups were identified through whom interviews were conducted. It should be pointed out that these family groups were chosen by the communities themselves to represent the farmers involved in the wastewater irrigation. This method was successful.

Table 1. Results of crop yields by wastewater irrigation

	Crop Yield (Tonnes/Hectare/Yield)				
Irrigation Water	**Wheat**	**Beans**	**Rice**	**Potatoes**	**Cotton**
1. Raw Wastewater	3.34	0.9	2.97	23.11	2.56
2. Settled Wastewater	3.45	0.87	2.45	20.25	2.30
3. Stabilization Pond Effluent	3.45	0.78	2.98	22.31	2.41
4. Fresh Water Plus NPK	2.70	0.75	2.03	17.16	1.70

Source : Mara and Caincross, (1989)

Community sensitization was performed in series of meetings to explain the study motives particularly the dangers associated with handling untreated sewage.

Results

Benefits of using wastewater for irrigation

The study revealed that the farming communities in Kitwe are encouraged to grow more crops for human consumption and market because of the expected yields when wastewater is used for irrigation. This is supported by Shuval et al, (1986) and also contends that recycling wastewater by means of agricultural irrigation offers a number of potential benefits. In Zambia, the benefits are found to be as follows :-

Increase in crop yield in Zambia

The increase in crop production resulting from the use of wastewater in Kitwe has boosted the farmer's incomes significantly. Table II reveals that an average family realizes a sum of K909,000 (US$ 303.00) per month of the irrigation season. This monthly income cannot be compared with the low salaries of approximately K200,000 or US$ 66.70 that an average civil servant or school teacher receives. According to Zambia Daily Mail, (1999), President Chiluba of Zambia described the salaries for government workers "as too low for anyone to make a comfortable living on." From the foregoing, it is clear that the farmers working in these fields where wastewater irrigation is practiced, has a higher income base than some of the government workers in the country.

The cost of using wastewater for irrigation

It has been established that in Kitwe that wastewater irrigation can do great harm to the environment and cause illness to human beings whenever it is used. However, the sensitization campaign on health in Ndeke and Mulenga townships might address this problem. Some of the disadvantages of wastewater irrigation are as follows :-

Transmission of communicable diseases

Oomen et al, (1990) points out that the harmful effects of wastewater irrigation is that it can spread water related diseases and thus cause the consequence sufferings of millions of human beings. This is true of the workers and those who consume the produce which is grown in these areas and those who live nearby the markets of Chisokone, Kapoto, Mufuchani, Musonda and Riverside in Kitwe that they are at risk of contracting the waterborne diseases. Kakungu, (1999) reports that diarrhea cases in children have been increasing since the1997/98 rain season in Ipusukilo clinics of Kapoto suburb. Further study is necessary to establish the source of this epidemic. For example, it is not clear as to whether the cause of diarrhea is consuming contaminated vegetables bought from the wastewater irrigated areas.

Rundown of wastewater collection system

Manhole covers

The manhole covers have been displaced or broken to gain access to the sewage flow. The outlet of the manhole is blocked so that sewage entering it can build-up and eventually overflow. The overflow is led into the furrows that provide wastewater into the crop field.

The manhole without covers pose the following dangers :-

- The runoff generated by rainfall will dump debris, sand particle etc into the manhole and eventually fill it up
- Some people use the open manhole as a solid waste disposal pit and hence render it useless

Table 2. Yields versus sales in wastewater irrigated plots (average size of 0.25 hectares)

Type of crop	Yield/plot (kg)	Amount in (ZMK)	1994/95 (US$)	Amount in (ZMK)	1997/98 (US$)	Amount in (ZMK)	1998/99 (US$)
1. Tomato	1,500	750,000	395.00	750,000	326.00	900,000	300.00
2. Rape	58	11,800	6.00	15,000	7.00	20,000	6.80
3. Chinese Cabbage	210	10,000	5.50	15,000	7.00	20,000	6.80
4. Pumpkin Leaves	228	30,000	16.00	35,000	16.00	48,000	16.00
5. Green Maize	60-70 cobs	16,500	8.70	20,000	9.00	30,000	10.00
6. Beans	6	18,000	9.50	20,000	9.00	18,000	6.00
Totals		**K837,000**	**$440.00**	**K855,000**	**$375.00**	**K1,036,000**	**$345.60**

KEY
Kg = kilogramme,
US$ = UnitedStatesDollar,
ZMK = ZambianKwacha

Sewage treatment facilities

Most of the sewage flow is diverted to irrigate the fields. This abstraction leaves very little or no flow in sewers to be received at the sewage works for treatment. It has been found that the frequent breakdowns experienced by the sewage plants are as a result of the treatment facilities handling flows for which they were not designed.

The way forward

Since wastewater irrigation practice is a health hazard, it is important that the practice should conform to the rules and regulations established by the local authority such as Kitwe City Council. It is also important that Kitwe City Council enforces these regulations. Critical areas to look at are as follows :-

Education campaigns

A community awareness campaign is launched by Kitwe City Council in Kapoto, Musonda and Riverside suburbs which aims at raising the peoples' knowledge of health issues and the validity of treating sewage for both environmental and economic purposes. This campaign should spread to other suburbs which are close to wastewater irrigation fields.

Protective clothing

In Kitwe, the workers use bare feet and hands when they are irrigating. To avoid direct contact with water, the workers in the wastewater irrigated fields must wear protective clothing such as gloves, gum boots and overalls whenever they are irrigating.

Type of crop

To avoid health risks, farmers in wastewater irrigation should not be allowed to grow vegetables that are eaten raw e.g. salads. Tubers e.g. potatoes, yams, beetroots etc should also be restricted.

Conclusion

The paper has shown that there are real benefits in the use of wastewater for irrigation. However, this practice has shown serious negative effects. There is need to have a sustainable wastewater effluent disposal management programme. This programme should deny anyone access to sewage before it is treated. Failure to implementing this programme will result in outbreaks of epidemics such as cholera, dysentery and other diarrhea diseases. It is therefore imperative that the Kitwe City Council institutes necessary bye-laws that conform with safe disposal of sewage effluent and also environmental standards.

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