

II-471 REUSE OF WASTEWATERS FOR LOW-CONTACT HYDROPONIC IRRIGATION OF HIGH VALUE CROPS

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1. INTRODUCTION

Wastewater reuse for irrigation of (high value) crops is being increasingly viewed as one excellent way of augmenting existing and future water resources, promoting agricultural production and contributing positively to environmental pollution control(1). There is, however, general apprehension as to the impact such reuse might have on public health(2). One of the factors that determines the health impact of wastewater reuse is the choice of the method of application of waste to crops. This paper provides data and analysis on a novel pilot hydroponic technique for the application of wastewater to high value crops.

2. METHODS AND MATERIALS

The research studies were conducted at the University of Zambia, Zambia, during the period September to December, 1991. The experimental hydroponic unit was set up in a greenhouse and basically comprised two 400mm diameter x 775mm height containers, each having outlets leading directly into 4,75mm diameter x 2000mm length pipes filled with aggregate (refer to photos below). The high value crops used in this study were cabbage, lettuce and rape.

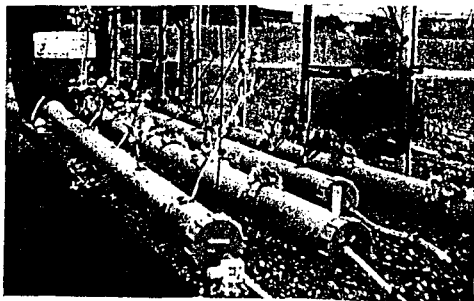


Fig.1: Tap Water Irrigation



Fig.2: Wastewater Irrigation

The partially treated (settled) domestic wastewater used in this study had the following mean composition:

| | |
|---------------------------------------|----------------------------------|
| pH 7.2 | Total Phosphorous 43mg/l |
| Chemical Oxygen Demand(COD) 138mg/l | Faecal Coliform 900000 per 100ml |
| Total Kjeldahl Nitrogen(TKN) 32.4mg/l | Suspended Solids 84mg/l |
| Potassium 10mg/l | |
| Nitrates(as N) 8.6mg/l | |

At the end of the experimental period (3 months), crop yield and crop microbiological quality were determined.

3. RESULTS AND DISCUSSION

For each of the three types of crop, the mean crop yields for a row of 5 plants (wet weight basis) were as presented graphically below.

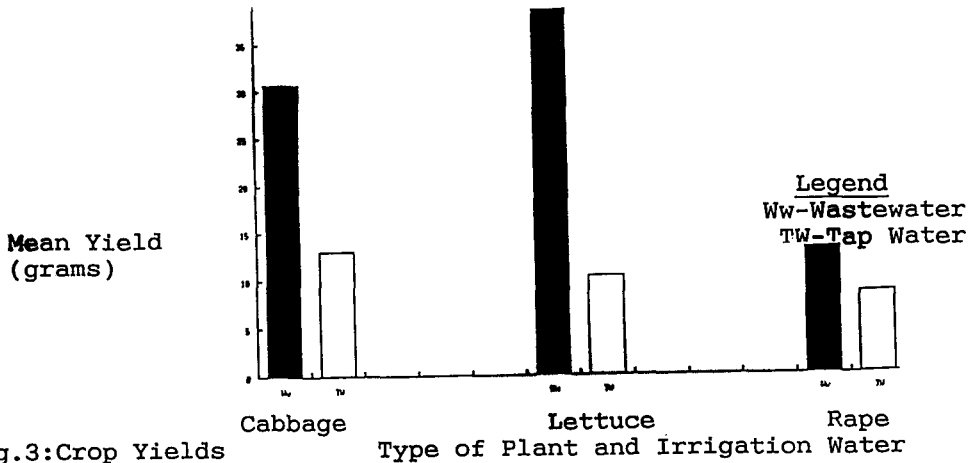


Fig.3: Crop Yields

Type of Plant and Irrigation Water

A crop microbiological quality determination was performed on the lettuces and the cabbages because of the likelihood of their being eaten raw. Faecal coliforms were used as indicators of faecal contamination. Both the crops irrigated with wastewater and those irrigated with tap water contained less than 200 Faecal coliforms per gram of crop.

The International Commission on Microbiological Specification for Foods (ICMSF) recommend that vegetables to be eaten raw should have an *Escherichia Coli* count of less than 1000/g (3). The microbiological quality of the high value crops tested in this study augurs very well with this recommendation; clearly demonstrating that the hydroponic unit is an effective low-contact hydroponic unit.

The yields of crops irrigated with wastewater were invariably and significantly higher than those of crops irrigated with tap water. This suggests that the nutrients in wastewater are in sufficient intensity and capacity to be reflected significantly in crop yield. The results also clearly show that the extent to which nutrients in wastewater are reflected in yield varies from crop to crop. It is therefore important that a particular wastewater be matched to a particular crop if maximum benefit is to be obtained from wastewater irrigation. In some cases, supplementary fertilisers may be required to make good the nutrients that may be deficient in wastewater.

4. CONCLUSIONS

It is concluded that the pilot hydroponic unit provides an effective barrier against microbiological contamination of high value crops so irrigated. When compared with fresh water, the nutrient value of treated wastewater is reflected significantly in crop yield. It is also clear that different high value crops respond differently to hydroponic wastewater irrigation.

REFERENCES

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