The Social/Cultural Acceptability of Using Human Excreta (Faeces and Urine) for Food Production in Rural Settlements in South Africa

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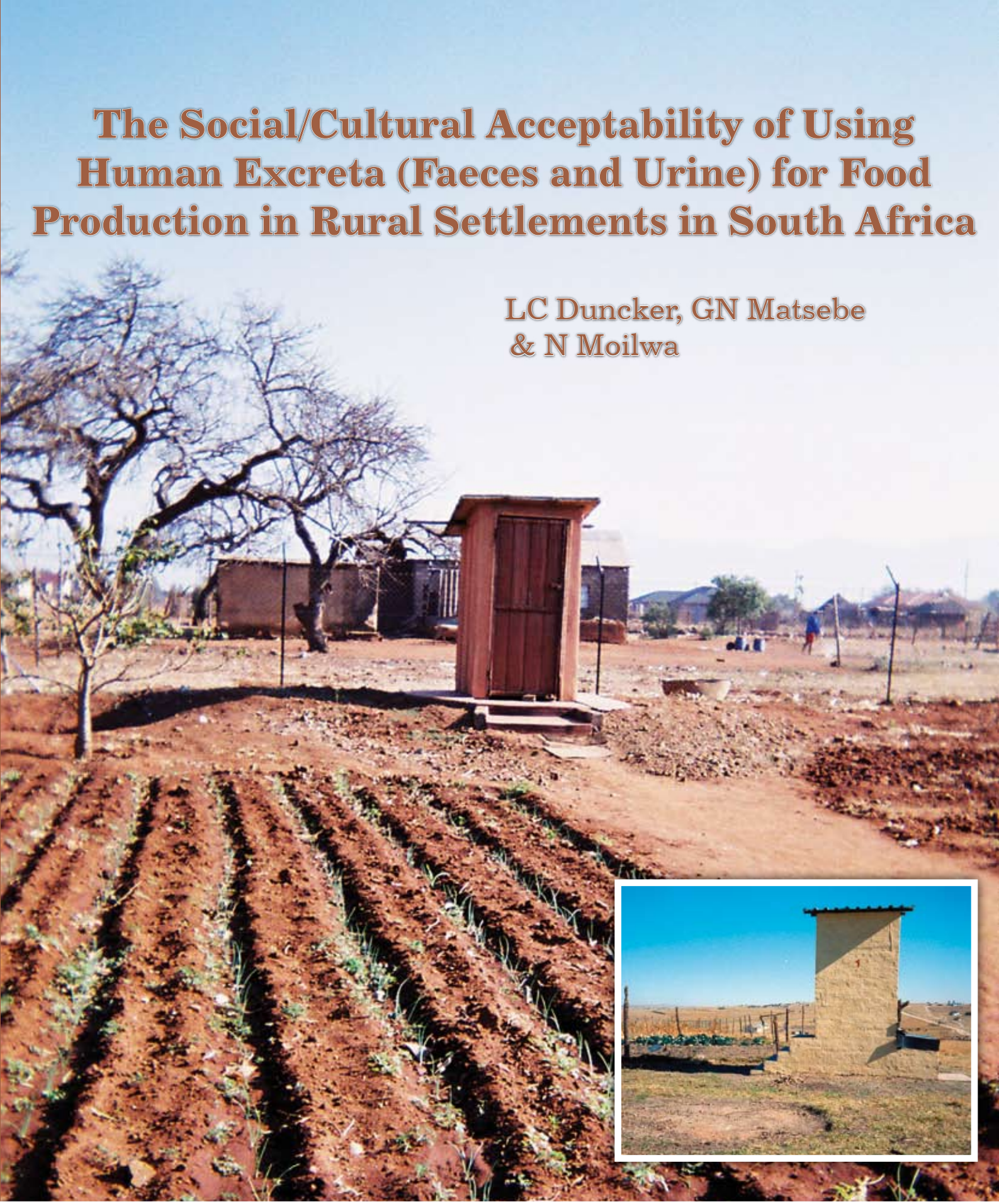

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THE SOCIAL/CULTURAL ACCEPTABILITY OF USING HUMAN EXCRETA (FAECES AND URINE) FOR FOOD PRODUCTION IN RURAL SETTLEMENTS IN SOUTH AFRICA

REPORT TO THE WATER RESEARCH COMMISSION

by

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EXECUTIVE SUMMARY

In 2006 the Water Research Commission (WRC) funded a scoping study to determine the acceptability of using human excreta as fertiliser for food production in rural settlements in South Africa.

The Bill of Rights of the South African Constitution (Chapter 2, Section 27.1b) entrenches every citizen's rights of access to sufficient food and water. Although food security has become a government priority and South Africa is considered to be self-sufficient in food production, an estimated 1,5 million children suffer from malnutrition and 14 million people are vulnerable to food insecurity. Food security is not only dependent on the ability of agriculture to produce sufficient food at a national level; food insecurity also results from the failure of communities to guarantee access to sufficient food at the household level.

Agriculture, which includes all economic activities from the provision of farming inputs to farming and value-adding, remains an important sector in the South African economy despite its small direct share of the total gross domestic product (GDP). In South Africa 72% of the poor live in rural areas and 18% of the poor live in urban areas. Also, 70% of all rural people are poor, while 30% are relatively well-off. The White Paper on Agriculture places an emphasis on food security, especially for the poor. The rural poor are prioritised for funds and support from national and provincial government.

But still, the poor need to grow food and the relatively high cost of standard compost production and chemical fertilisers is a constraint. Most of the poor people also live in areas where the soil is not good enough for growing food and chemical fertilisers are needed to replenish soil. Ultimately, these chemical "pollutants" may lead to loss of fresh water, food insecurity, destruction of soils, loss of biodiversity on land as well as in marine environments, global warming and depletion of the ozone layer.

Ecological sanitation is a sanitation system that turns human excreta into something useful and valuable, with minimum risk of environmental pollution and no threat to human health. It is a sustainable closed-loop system that treats human excreta as a resource, not as a waste product. Excreta are processed until they are free of disease organisms. The nutrients contained in the excreta may be recycled and used for agricultural purposes.

However, perceptions influence and guide behaviour, motivate or de-motivate all actions and determine the future success of technologies and/or products. To manage the future of a technology or a product, perceptions have to be managed and applied to adapt the strategy of technology implementation and transfer to the tasks of creating, shifting, changing and managing perceptions.

Introducing and operating sanitation systems that promote the use of human excreta in rural areas require a combination of technical and managerial aspects that fit the prevailing socio-cultural context in the specific area. An in-depth understanding of the social and mental fabric concerning people's views on the recirculation of nutrients is necessary in order to understand the motivational factors behind people's acceptance or rejection of using human excreta for food production. No research has been conducted so far in this field of study in South Africa.

This project was a scoping study to investigate the use of human urine and human faeces worldwide and in South Africa and to determine, through primary research, what the attitudes and perceptions of people in rural settlements regarding the use of human excreta for food production.

A comprehensive literature review showed that the use of human urine and faeces for food production internationally, especially in China, is an old and well-known practice. In some

countries in Africa the use of human urine and faeces is also accepted. However, in South Africa the handling of human excreta and the use of human excreta for food production are still very foreign ideas and generally not acceptable. Human excreta are seen as waste products, unhealthy, unhygienic and detrimental to humans.

Attitudes and perceptions about health hazards and people's revulsion against faeces and urine vary between cultures all over the world, and often people's attitudes towards urine differ from those towards faeces. Every social group has a social policy for excreting; some norms of conduct will vary with age, marital status, sex, education, class, religion, locality, employment and physical capacity. For example, a Koranic edict considers urine to be a spiritual pollutant, and Islamic custom demands that Muslims minimise contact with human excreta. Another example is the belief that urine has a disinfectant property. In the Kagera area in Tanzania, when someone has inhaled poison, urine has been given to the person to drink as a neutraliser (medicine) or antidote. It has also been used as a pesticide to kill banana weevils.

From the literature review it became clear that each social group has different views on the use of human excreta. Primary research needed to be conducted to determine the views of the people in South Africa. The methodological approach for the field research was based on the KAP (knowledge, attitudes, practices) study that was developed by the World Health Organisation (WHO) in 1978. The emphasis of the KAP study is on qualitative data to determine knowledge, attitudes and practices, and not on statistical analysis of the data. These data are instrumental in identifying the factors that influence behaviour.

The research method focused on gathering information in a way that reflected the true situation in the community as closely as possible, without reducing the research to the level of "count 'em" mechanics. Because this is a scoping study only, the opportunity for in-depth investigation was limited. Various options were considered (such as questionnaires, key informant interviews, structured household surveys, community workshops, semi-structured household interviews, focus group discussions and observation) to obtain as much information as possible with a limited sample size. It was decided to conduct qualitative research through the use of unstructured household interviews while validating and cross-checking the responses by physical observation and small focus group discussions. This proved to be the most successful and unbiased way of collecting information about a sensitive issue such as household sanitation practices. For the purposes of this research a questionnaire would not have been suitable due to the sensitivity of the subject studied.

The key elements of the interviews were the verbal give-and-take between interviewer and interviewee. The questions during the interview were respondent-generated, meaning that the answer to a previous question led the interviewer to the next question. The information was gleaned from the discussions around gardening, food production and use of the products from the urine diversion (UD) toilet and people's perceptions and feelings regarding it. In cases where certain information was not provided during the discussions, questions were posed to probe a specific issue. In many cases the discussion started with only one or two respondents in the household, but other members (sometimes up to ten) of surrounding households would join the discussion. In these cases the discussion formed a focus group and the results were classified as results from a focus group discussion.

The interviews were particularly useful for exploring complex and emotionally loaded topics, such as sanitation, human excreta, beliefs and opinions. The limitation of the interviews was that they were time consuming and exhausting for both interviewer and interviewee. The open-ended questions were well suited to determining how people reason and think about an issue, and could be used for respondents who were very young, very old, infirm, or uninterested in the topic.

A 10% random sample of households in various settlements in each of four provinces was selected. The Northern Cape, Eastern Cape and KwaZulu-Natal were selected for diversity in terms of cultural groupings, as well as exposure to information and/or use of urine diversion sanitation and the products (human excreta) from the toilet. Limpopo Province was selected for the fact that urine diversion sanitation is relatively unknown in the province. This objective was to compare the perceptions and attitudes of people who had not been exposed to urine diversion sanitation with those of people who know it well. A total of 120 interview schedules were completed, covering 124 respondents who represented 704 household members.

The field research showed that the general norm of not physically handling human excreta, because it is unhygienic, is still very strong among the respondents. Even though they said that they would in future use human excreta in their gardens and eat the food produced, it remains to be seen whether they will in actual fact do so.

Achieving or marketing ecological sanitation solutions requires a change in how people think about and act towards human excreta. The acceptability of this technology varies from one country to another. Some cultures or social groups do not accept the handling and direct use of human excreta. Therefore, cultural taboos in many parts of the world will have to be changed for people to accept using their faeces and urine as fertiliser for food crops. Adequate education and hygiene awareness campaigns in communities receiving ecosan toilets should be a prerequisite for the maintenance of public health. Demonstration toilets, peer education and peer pressure were reported to bring about attitude change in other countries. Demonstration creates awareness and visual aids improve and enhance understanding.

An in-depth study of the factors that are important in changing perceptions and views of people regarding the use of human excreta for food production will clearly be of great value, as the research showed that people are open to changing their minds. Such a study should focus on the areas where urine diversion sanitation projects were successfully and sustainably implemented, and where the households are actively using human excreta in their vegetable gardens.

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The project was only possible with the cooperation and goodwill of many individuals and institutions and the authors hereby wish to extend their thanks and appreciation to the following:

- The communities that the research team worked in, for their cooperation in providing the information needed in such an honest and generous way. All the people from these communities were very patient with the interviewers, even when sensitive issues were discussed.

- The community facilitators who assisted the researchers in each of the communities. Their assistance in the field and their contribution to this document were invaluable.

- The organisations and researchers who were and are involved in the field of ecological sanitation across the world, for providing valuable information and for sharing their experiences.

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LIST OF PICTURES (Photos by courtesy of Louiza Duncker, Gertrude Matsebe, Nancy Moilwa and Aussie Austin).

1. INTRODUCTION

The Bill of Rights of the South African Constitution (Chapter 2, Section 27.1b) entrenches every citizen's right of access to sufficient food and water (South Africa, 1996). Although food security has become a government priority and South Africa is considered to be self-sufficient in food production, an estimated 1,5 million children suffer from malnutrition and 14 million people are vulnerable to food insecurity (National Treasury, 2003; de Klerk et al., 2004). Food security is not only dependent on the ability of agriculture to produce sufficient food at a national level; food insecurity also results from the failure of communities to guarantee access to sufficient food at the household level (Clover, 2003). Analysts believe that Africa's current food emergencies have resulted from a combination of problems and that no single factor is uniquely responsible. Environmental factors such as land degradation, deforestation, waterlogging and salinisation have resulted in increasing reports concerning the impacts of these factors on the ability of Africa to feed itself (Clover, 2003).

Although, more than R2 billion is spent annually on commercial fertilisers in South Africa, financial constraints make these products inaccessible to poor farmers and households (Dept. of Agriculture, 2004). The South African Department of Agriculture's definition of food security includes food availability, food access and reliability of food, and it is the lack of access of the poor to these fertilisers that could have significant impacts on food security in South Africa (Dept. of Agriculture, 2002). However, international trends to suggest low-cost, ecologically suitable alternative fertilisers, such as human excreta. Although South Africans generally regard human excreta as a waste product, biophysical concerns such as land degradation, declining soil fertility and limited phosphorus reserves (Rosemarin, 2005) have made it necessary to determine means of changing this perception to one that views excreta as a valuable and useful resource. Urine is rich in nitrogen, while faeces are rich in phosphorus, potassium and organic matter (Jönsson et al., 2004). Use of human excreta for agricultural purposes may not only have the direct benefits of protecting and improving natural resources such as water and soils, and enable households to increase food crops, but also have indirect the benefit of improved food security, resulting in improved health of the individual, greater productivity, increased economic output and opportunities, and a decreasing burden on social services.

The Strategic Framework for Water Services (DWAF, 2003) defines basic sanitation services in South Africa as the provision of a basic sanitation facility, the sustainable operation of the facility, and the communication of good sanitation, hygiene and related practices. No mention is made in the policy of the use, reuse or recycling of household waste products, of minimising the impact on natural resources or of providing sanitation services in a manner that results in efficient use of natural resources. Although more than 60 000 source-separating toilets have been supplied as basic sanitation facilities in South Africa, the use of human excreta for maintaining soil resources is not generally being promoted.

Introducing and operating sanitation systems that promote the use of human excreta in rural areas require a combination of technical and managerial aspects that fit the prevailing socio-cultural context in the specific area. An in-depth understanding of the social and mental fabric constituting people's views on the recirculation of nutrients is necessary in order to understand the motivational factors behind people's acceptance or rejection of using human excreta for food production. No research has been conducted so far in this field of study in South Africa, and therefore the proposed study is required to investigate the status quo, determine views on and attitudes of people towards the use of human excreta in food production, and guide relevant future interventions and actions regarding the use of human excreta.

2. BACKGROUND

South Africa is characterised by high levels of poverty, especially in rural areas where approximately 70% of South Africa's poor people reside. Their incomes are constrained because the rural economy is not sufficiently vibrant to provide them with remunerative jobs or self-employment opportunities, Therefore they have to rely on subsistence farming and food production.

South Africa has an essentially dual agricultural economy, comprising a well-developed commercial sector and a predominantly subsistence-oriented sector in the rural areas. The sharp increase in food prices during 2002 and onwards was one of the most important issues facing the Department of Agriculture, due to the impact it had on the poor and on food security in the southern African region as a whole. Government's response has centred on a package of relief measures to supplement the income of the poor, to contain price pressures on basic foods, and to strengthen the ability of the poor to grow their own food. These measures have helped to cushion the impact of inflation on vulnerable groups. Social grants have been increased by an average of 15,2%, and the private sector has also responded through limited maize subsidies. Government is also examining the feasibility of a longer-term food security programme to provide households with seeds and tools for subsistence agriculture. In addition, a Food Pricing Monitoring Committee has been established to monitor the prices of a basket of basic food items (http://www.southafrica.co.za/agriculture).

But still, the poor need to grow food, and the relatively high cost of standard compost production and chemical fertilisers is a constraint. Most poor people also live in areas where the soil is not good enough for growing food and chemical fertilisers are needed to replenish it. Eventually the result is a depleted soil which becomes lifeless, creating unhealthy plants that require pesticides. Fertilisers and pesticides also leach into the environment, as do hormones and antibiotics ingested by animals. These problems affect human health in a negative way: diarrhoea, infant mortality, low birth weights, malnutrition, as well as cancer and other chronic diseases. Ultimately, these pollutants may lead to loss of fresh water, food insecurity, destruction of soils, and loss of terrestrial as well as marine bio-diversity, global warming and depletion of the ozone layer.

3. PURPOSE AND OBJECTIVES OF THE STUDY

3.1 Purpose of the Project

This project was a scoping study to investigate the use of human urine and human faeces both worldwide and in South Africa and to determine, through primary research, the attitudes and perceptions of people in rural settlements towards the acceptability of using of human excreta for food production.

3.2 Objectives of the Project

The objectives of the project were the following:

- To review documentation, research reports, books, journals, etc., on the use of human excreta for food production both worldwide and in South Africa, to assess what knowledge on the social/cultural aspects of the use of human excreta in food production already exists.
- To research perceptions regarding human excreta and the level of acceptability of their use in gardens/fields in settlements in the rural areas of the Eastern Cape Province, KwaZulu-

Natal, Northern Cape Province and Limpopo Province (one settlement per province) in particular.

- To analyse the data, to document the results of the research and to make recommendations regarding the acceptability and viability (positive/negative) of using human excreta for food production in rural areas.

4. RESEARCH METHODOLOGY

4.1 Research Approach

The methodological approach for this research was based on the KAP (knowledge, attitudes, practices) study that was developed by the World Health Organisation (WHO) in 1978. The emphasis of this KAP tool is on qualitative data to determine knowledge, attitudes and practices and not on statistical analysis of the data. These data are instrumental in identifying the factors that influence behaviour. The method concentrates on small group discussions or individual discussions with two-way communication in exchanging information about attitudes and behaviour. The advantages of using a KAP method is that it provides more accurate insight into what people actually think than other techniques. The results produced also reflect social realities more accurately than a method that asks people to act in isolation.

This is also a qualitative research method that deliberatively gives up on quantity in order to reach deeper analysis of the object studied. The simplest definition is that qualitative methods involve the collection and analysis of information based on its quality and NOT quantity. These are methods in which the results are primarily conveyed in visual or verbal form to establish context and un-constructed logic to unravel the meaning of research. Qualitative methods are commonly used in conjunction with quantitative methods. By using qualitative methods it is often possible to understand the meaning of the numbers produced by quantitative methods (Clarke, 2005 and Neuman, 1997).

4.2 Research method

The research focused on gathering information from the literature review and the field research in a way that reflected the true state in the community as closely as possible, without reducing the research to the level of “count ‘em” mechanics. Because this is a scoping study only, the opportunity for in-depth study was limited; therefore various options were considered (such as questionnaires, key informant interviews, structured households surveys, community workshops, semi-structured household interviews, focus group discussions and observation) for the field research, in order to obtain as much information as possible with a limited sample size. It was decided to conduct qualitative research through the use of unstructured household interviews, while validating and cross-checking the responses by physical observations and small focus group discussions because this had proved to be the most successful and unbiased way of collecting information about a sensitive issue such as household sanitation practices.

The method for the research focused on participatory data gathering in the target communities. Members of the respective sanitation committees in the target communities were approached to assist with sampling of the target households, as well as liaison with the community members, and the data gathering process.

The work programme for this scoping study research was developed in response to the attributes of the areas of investigation (see Annexure A for a map). The process was the following:

- **Phase 1: Literature review**
  During this phase documentation, research reports, books, journals, etc., on the use of human excreta for food production world wide and in South Africa were reviewed.

- **Phase 2: Research preparation**
  This phase comprised liaison with community structures and prominent residents in the target settlements in order to inform the community members of the purpose of the intended research and gain access to the households and the residents.
  Activities:
  - Community arrangements and communications with target settlements in Eastern Cape, Northern Cape, KwaZulu-Natal and Limpopo Province (one settlement per province) for community workshops and discussion groups.
  - Setting up meetings with key community members.
  - Development of an interview schedule for information/data gathering (quantitative and qualitative).

- **Phase 3: Field research**
  The field research was conducted in the target settlements using an information gathering schedule to structure household interviews and focus group discussions.
  Activity:
  - Gathering data in rural settlements in Eastern Cape, Northern Cape, KwaZulu-Natal and Limpopo Province.

- **Phase 4: Data analysis and report writing**
  The information gathered was analysed to depict the status quo in rural settlements regarding the use of human excreta (faeces and urine) for food production. A final research report (this report) was compiled, which includes the findings of the research as well as recommendations for improving the acceptability of using human excreta for food production.
  Activities:
  - Data capturing
  - Data analysis and evaluation
  - Conclusions
  - Report writing in MicroSoft Word.

4.3 Research tool

The research tool, which was developed based on the information obtained through the literature review, covered the following topics:

- Personal information of the interviewee
  - Gender
  - Position in household
  - Level of education

- Household information
  - Number of people living in the household, by age and gender

    - Average monthly income of the household
    - Source of income.
- Nutrition
    - Gardens and maize fields and source of water for gardens
    - Location of gardens and maize fields
    - Purpose of gardens and maize fields
    - Income from gardens and maize fields
    - Responsibility for gardens and maize fields
    - Use and type of fertiliser
    - Expenditure on fertiliser and expenditure on produce
    - Use of compost.
- Sanitation
    - Types and use of toilets
    - Perception of toilets
    - Preference regarding toilets.
- Use of human excreta
    - Disposal of human excreta
    - Collection service.
- Perceptions regarding human excreta
    - The effects of human urine and human faeces on themselves, by gender
    - The effects of human urine and human faeces on plants
    - Knowledge and perceptions of the fertiliser value of human urine and human faeces
    - Food that could be cultivated using human urine and human faeces
    - Acceptability of eating food cultivated with human urine and human faeces
    - Possibility of people changing their minds.

The questions were respondent-generated, meaning that the answer to a previous question led the interviewer to the next question. The interviewers started discussing gardening and food production and eventually the UD toilet in general and guided the interviewees to the information needed. The information was gleaned from the discussions around the gardening, food production and use of the products from the UD toilet and people's perceptions and feelings regarding it. In cases where certain information was not provided during the discussions, questions were posed to probe a specific issue. In many cases the discussions started with the one or two respondents of the household, but other members (sometimes up to ten) of the surrounding households joined the discussions. In these cases the discussion formed a focus group and the results were classified as results from a focus group discussion.

The key element of the interviews was the verbal give-and-take between interviewer and interviewees. The interviews were particularly useful for exploring complex and emotionally loaded topics, such as sanitation, human excreta, beliefs, opinions and characteristics. The limitation of the interviews was that they were time consuming and exhausting for both interviewer and interviewee. The open-ended questions were well suited to determining how people reason and think about an issue, and could be used for respondents who were very young, very old, infirm, or uninterested in the topic. For the purposes of this research a questionnaire would not have been suitable, owing to the sensitivity of the subject studied.

5. DATA ANALYSIS

5.1 Sampling

The sample size for this research project needed to be small because it is a scoping study and there were budget constraints. The settlements selected in each of the Northern Cape, the Eastern Cape, KwaZulu-Natal and Limpopo Province were chosen for their number of households being 300 or less, to make the sample size manageable but still representative (10%) within the limited budget of the project.

The Northern Cape, Eastern Cape and KwaZulu-Natal were selected for their diversity in terms of cultural groupings as well as exposure to information and/or use of urine diversion sanitation and the products (human excreta) from the toilets. Limpopo Province was selected for the fact that urine diversion sanitation is relatively unknown in the province, in order to compare the perceptions and attitudes of people who have not been exposed to such sanitation with those of people who know it well.

A 10% random sample of households in each of the four provinces was selected, except for the three settlements around Mthatha in the Eastern Cape where a 33% sample was selected due to the small number of urine diversion toilets in each of the three settlements. A total of 120 interviews were conducted, 30 in each province. A total of 120 interview schedules were completed, covering 124 respondents who represented 704 household members. The responses originated from the following areas (see Annexure A for a map of the locations):

Table 1:

AREA	TOWN/ VILLAGE	DATES OF FIELD RESEARCH	INTERVIEW SCHEDULES COMPLETED	NUMBER OF INTERVIEWEES
Northern Cape	Augrabies	July 2006	30	34
Eastern Cape	Sinyondweni	July 2006	5	5
	Manyosini		5	5
	Gwebindkundla		5	5
	Scenery Park (East London)		15	5
KwaZulu-Natal	Kwa-Shozi	August 2006	30	30
Limpopo	Madombidza	August 2006	30	30

5.2 Interpretation and analysis

The interview schedule contained quantitative as well as qualitative data.

For the purpose of quantitative analysis, the questions that could be quantified were selected and coded. The data from these quantitative questions were captured and analysed on MicroSoft Excel.

For the purpose of qualitative analysis, the qualitative questions were selected and coded. The responses to the qualitative questions were listed and prioritised according to the frequency (number of times) a response was given by different interviewees.

6. DEFINITIONS OF TERMS

In order to have a common understanding of what is discussed in this report, the terms used in the discussion are defined below.

6.1 Food security

The most influential and widely accepted definition of food security is the one by the Food and Agriculture Organisation of the United Nations: "access by all people at all times to enough food for an active and healthy life" (FAO, 1999). This definition encompasses many issues, but above all the following key components:

- **Availability** is achieved when both safe and nutritious, as well as sufficient quantities of food are consistently available to all individuals within a country.
- **Access** is ensured when all persons within a household have adequate resources to obtain appropriate foods for a nutritious diet.
- **Adequacy** in terms of quality, quantity, safety, cultural acceptability, and food preferences (Baumgartner & Belevi, 2001).

A discussion document on a food security policy for South Africa (FSWG, 1997) emphasises the constraint imposed by a lack of institutional capacity in poor areas on targeting and effective delivery of food security initiatives. Recommendations made in this discussion document are that institutional reform for food security should include enhancing coordination of food security programmes and building capacity to manage food security options (Austin & Visser, 2002). Using human excreta as fertiliser for food production is one of the options in building capacity for food security.

6.2 Agriculture in rural areas

Agriculture, which includes all economic activities from the provision of farming inputs, to farming and value adding, remains an important sector in the South African economy, despite its small direct share of the total gross domestic product (GDP). In South Africa 72% of the poor live in rural areas and 70% of rural people are poor (Austin & Visser, 2002). The White Paper on Agriculture (Department of Agriculture, 2001) places an emphasis on food security, especially for the poor. The rural poor are prioritised for funds and support from national and provincial government.

Agriculture provides food and fibre, meeting two basic human needs. It has successfully met these needs through increased productivity from when the population of this country was a mere four million at the beginning of the 20th century to the present 40 million. Farmworkers, farmers and their families also contribute to the economy when they spend their wages and salaries on consumer goods and services, or when they buy inputs for production in the next season. In this way agriculture becomes the backbone of growth and development. Its influence on the economy has been demonstrated by the consequences of the floods that destroyed parts of the

Limpopo and Mpumalanga provinces in February 2000, when the GDP growth rate of the country dropped by 1% (Department of Agriculture, 2001).

Primary agriculture accounts for 4,5% of the GDP of South Africa, while the larger agro-food complex accounts for another 9%. Commercial farmers exported about R16 billion worth of products in the year 2000, or nearly 10% of South Africa's total exports. These commercial farmers employed about 1 million workers, or about 11% of the total formal employment of South Africa. Many farmworkers live on commercial farms and their children receive education on farm schools. Commercial farms, therefore, provide livelihoods and housing to about six million family members of one million employees and provide for their education needs. There are also 240 000 small farmers who provide a livelihood to more than one million of their family members and occasional employment to another 500 000 people. They supply local and regional markets where large numbers of informal traders make a living. Furthermore, there are an estimated 3 million farmers, mostly in the communal areas of the former homelands, who produce food primarily to meet their family's needs. Finally, the productive and social activities of rural towns and service centres are centred on their support to primary agriculture and related activities such as agri-tourism and game farming. More than half of the provinces and about 40% of the country's total population are primarily dependent on agriculture and related industries (Department of Agriculture, 2001).

According to the Organisation for Economic Coordination and Development's (OECD) Policy Brief on Agricultural Policy Reform in South Africa, the potential of agriculture itself to reduce poverty is limited. The main potential to reduce poverty in rural areas lies in the provision of social security, education and training as well as health care, and in the development of adequate infrastructures in rural areas (OECD, 2006).

6.3 Sanitation

The Water Services White Paper includes the following definitions of basic sanitation (DWAF, 2003):

- *A basic sanitation facility is defined as "a sanitation facility which is safe, reliable, private, protected from the weather, ventilated, keeps smells to the minimum, is easy to keep clean and minimises the risk of the spread of sanitation related diseases by facilitating the appropriate control of disease carrying flies and pests, and enables safe and appropriate treatment and/or removal of human waste and black or grey water in an environmentally sound manner".*

- *A basic sanitation service is "the provision of a basic sanitation facility which is easily accessible to members of a household, has the necessary operational support for the safe removal of human waste and black and/or grey water from the premises where this is appropriate and necessary, and promotes the communication of good sanitation, hygiene and related practices".*

According to the National White Paper on Basic Household Sanitation (DWAF, 2001) "*sanitation refers to the principles and practices relating to the collection, removal or disposal of human excreta, household waste water and refuse as they impact upon people and the environment. Good sanitation includes appropriate health and hygiene awareness and behaviour, and acceptable, affordable and sustainable sanitation services*".

The minimum acceptable basic level of sanitation is:

- appropriate health and hygiene awareness and behaviour;
- a system for disposing of human excreta, household waste water and refuse, which is acceptable and affordable to the users, safe, hygienic and easily accessible, and which does not have an unacceptable impact on the environment; and
- a toilet facility for each household.

Sanitation includes both the 'software' (understanding why health problems exist and what steps people can take to address these problems) and 'hardware' (toilets, sewers and hand-washing facilities). Together, they combine to break the cycle of diseases that spread when human excreta and waste are not properly managed (DWAF, 2002a).

6.4 Ecological Sanitation

Ecological sanitation (ecosan) is a strategic and comprehensive sanitation approach that integrates all aspects of sanitation such as human waste, solid waste, waste water and drainage. This approach links sanitation with agriculture and food production. Hannan & Andersson (2002) quoted the definition of ecological sanitation as "*an ecosystem approach to waste disposal based on three key principles – that sanitation should be safe from a health perspective; 'green' or non-polluting; and be based on principles of re-use and recycling of the valuable nutrients in human excreta*". Chaggu & John (2002) defined ecological sanitation as "*a system that makes use of human 'waste' and turns it into something 'useful and valuable', with minimum pollution of the environment*". In essence, it consists of using latrines that are safe and ecologically sound and designed in such a way that the end products can be easily transferred into agriculture or forestry (Austin et al*.,* 2005).

Ecological sanitation is therefore a sanitation system that turns human excreta into something useful and valuable, with minimum risk of environmental pollution and no threat to human health. It is a sustainable closed-loop system that treats human excreta as a resource, not as a waste product. Excreta are processed until they are free of disease organisms. The nutrients contained in the excreta may be recycled and used for agricultural purposes (Austin & Duncker, 2002).

6.5 Urine diversion sanitation

Urine diversion sanitation is one of the sanitation technologies implemented in various parts of the world (urban and rural, developed and developing countries), including South Africa. Its most important feature is the low moisture content in the faeces receptacle. The urine is diverted at source by a specially designed pedestal and is not mixed with the faeces. A schematic representation is given in Figure 1 below.

A pit is not necessary as the entire structure may be constructed above ground, or may even be inside the dwelling. Ash, dry soil or sawdust is sprinkled over the faeces after each defecation. The ash absorbs the moisture and also controls odours and flies. The dry conditions facilitate rapid desiccation of the faeces. The desiccated faeces make a good soil conditioner, while urine is an excellent source of fertiliser, being rich in nitrogen, phosphorus and potassium (Austin & Van Vuuren, 2001).

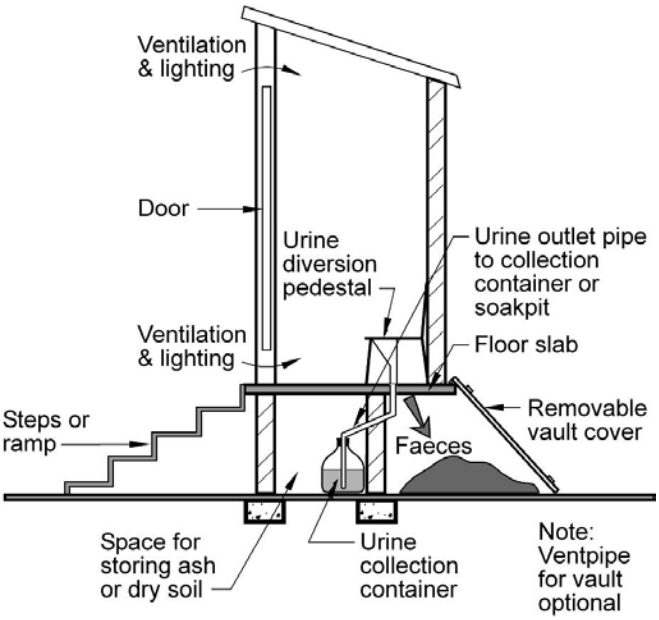


Figure 1: Schematic representation of a urine-diversion (UD or "dry-box") toilet (Austin & Duncker, 2002).

Urine diversion sanitation technology has been used successfully for decades in many developing countries such as Vietnam, China, Mexico, El Salvador, Ecuador, Guatemala, Ethiopia, Zimbabwe and, since 1997, also in South Africa.

6.6 Perceptions

The word 'perception' has become part of our everyday language and fewer people today dispute the importance of perceptions and the notion that they impact upon the individual's decision making behaviour. People are motivated by and act upon their perceptions rather than any rational thought process. People's behaviour is not motivated by rational needs, but rather by what they 'feel' or 'perceive' their needs/wants to be. Their choice of product to satisfy their needs/wants is influenced by their feelings towards that entity, as well as their perceptions of it and its ability to satisfy their needs/wants. Their perceptions do not necessarily correspond with the developer's view of its reality, because reality is subjective and each person's reality is unique to them, and is based upon their interpretation of the events and circumstances in which they find themselves. Thus reality is the perception of the person perceiving it (www.objectivity.co.za).

Perceptions are formed through:

- feelings, beliefs, mental pictures, gut feel;
- the sum total of perceptions of information accumulated over time, including experiences;
- the reality that pertains, although it may not be "true"; and
- change with changing circumstances or information.

Perceptions influence behaviour, guide all behaviour, motivate or demotivate all actions and determine the future success of technologies and/or products. To manage the future of a technology or a product, perceptions have to be managed and applied, so as to adapt the strategy of technology implementation and transfer to the tasks of creating, shifting, changing and managing perceptions (www.objectivity.co.za).

6.7 Attitudes

An attitude is one's basic 'mind set', one's outlook, how one views things. For example, people with different attitudes will view (perceive) the same situation from quite different perspectives. A particular situation will be seen as a problem to one person and an opportunity to another. It is usually the person who sees that situation as an opportunity that will be able to think of a useful solution to correct the situation. A positive attitude can see opportunities in a situation where a negative attitude will only see the problems and obstacles. The difference between a positive attitude and a negative attitude can often mean the difference between success and failure of a technology or a product. A positive attitude will transmit positive and friendly signals, whereas a negative attitude repels people (www.objectivity.co.za).

7. LITERATURE REVIEW

This section discusses the views, attitudes and perceptions of people across the globe and in South Africa towards the use of human excreta for food production.

7.1 Use of Human Urine Internationally

Different authors have shown that urine contains more nutrients than faeces. For example, Drangert (1998) indicated the nutrient content value of urine as one of three reasons to counteract urine blindness (a negative attitude towards urine). An average person produces about 500 litres of urine per year (Jönsson et al., 2004). Urine contains the major part of the daily excretion of nitrogen (N), Phosphorous (P) and potassium (K) (Schönning, 2001). She indicated that it should be considered a valuable fertiliser. The plant availability of N urine is the same as that of chemical urea or ammonium fertiliser (Jönsson, 2004). The nitrogen efficiency of urine is approximately 90% of that of mineral fertiliser (Johansson et al., 2001) and it is low in heavy metals. According to Esrey & Anderson (2001), urine has been used as a resource in many parts of the world for centuries. In some societies, however, excreta (particularly faeces) have for many centuries been considered dirty.

However, experience has shown that urine diversion sanitation is acceptable, and the handling of urine poses far fewer taboos than that of faeces. According to Winblad (1997), urine diluted with water can be used directly in the garden or it can be stored and used at a later date. Olsson (1996) warned that the risk of disease transmission has to be taken into account when recirculating human urine for agricultural production, because small amounts of faecal material may be introduced into the urine fraction.

7.1.1 Latin America

In Mexico, fermented urine is recommended as a fertiliser. Before sealing the container to avoid loss of nitrogen, users often add a handful of soil as a catalyst for the fermentation process. According to Ceballos (1997) in a case study of dry sanitation in Morelos, Mexico, fermented urine is diluted before watering plants. For fertilisation purposes, users have reported varied dilution ratios of urine to water (from 1:5 to 1:4) (Clark, 2003). Unfermented urine can be sprayed as a fungicide. Indigenous people in south-eastern Mexico claim that the use of urine as a fungicide was a traditional Mayan practice (Clark, 2003).

Esrey et al. (1998) mentioned the fact that urine used in urban family scale gardening has taken place for a number of years through the ANADEGES network in Mexico City. This project, managed by CEDICAR (Centro de Investigaci`ony Capacitati`on Rural A.C. – Rural Research and Training Centre), which is an ANADEGES affiliate, involved 1 200 families who were producing vegetables in reused containers with worm composted kitchen waste, urine and leaves. This was done in response to rapid inflation, high unemployment and inadequate nutrition.

In Mexico City, experimentation with fermented urine to grow food showed that leafy vegetables do very well (Esrey & Andersson, 2001). These included lettuce, cilantro (coriander), parsley, celery, fennel, scented herbs, prickly pear, and chile piquin (bird peppers). Good results were also obtained with cauliflower, broccoli, cabbage and root produce (turnips, carrots, beets and onions). Fruiting plants, such as tomatoes, squash, cucumber, pepper and aubergines, however, did not do as well with fermented urine as with other fertilisers (Esrey & Andersson, 2001).

Sawyer (2003) demonstrated in a pilot project in the municipality of Tepoztlán in Morelos that it is feasible to harvest urine and develop a reuse system in the urban context. Achievement of the pilot project included harvesting urine in public places for use in agriculture. Through the project, various technologies have become available in the local market for the collection and storage of human urine. In Mexico, people are experimenting with urine in urban agriculture, as well as in growing traditional Mayan food grains (Strauss, 2000).

CEDICAR promoted containers for use with different types of compost and “liquid organic fertilisers”, including human urine, for household and community production of vegetables and herbs (Esrey & Andersson, 2001).

Esrey & Andersson (2001) indicated that other people in Cuernavaca, Mexico, experimented with human urine as a source of nitrogen in organic vegetable production. Esrey et al. (1998, as noted in Austin & Duncker, 2002: 67) mentioned that the urine, which has been stored in separate receptacles for three weeks, is applied to the vegetable containers after dilution with water on a 1:10 ratio. After several years of study it became clear that plants fertilised with urine grew more rapidly, and were larger and healthier than those grown using conventional agricultural techniques. Less water was used in this instance as well.

7.1.2 **Europe**

Urine was used in Europe in the olden times for household cleaning, softening wool, hardening steel, tanning leather and dyeing clothes. The Greeks and Romans used it to colour their hair, and African farmers used it in fermenting plants to produce dyes (Esrey & Andersson, 2001).

Sweden is probably the country with the most advanced system of collection and reuse of human urine, where it is practised by farmers on a large, mechanised scale. In a number of settlements (called ‘eco-villages’) or apartment blocks in the country the residents have ecological sanitation systems with urine diversion toilets. The urine from the houses or apartments is collected in large underground tanks, and what the residents do not use themselves is collected by farmers in road tankers and used for fertilising their crops. The usual practice is to spray it onto the lands while they are being prepared for planting, and then harrow it into the soil before sowing the seed (Austin & Duncker, 2002). It has been found to be a valid substitute for mineral fertilisers in growing cereals, with no negative impact on the crop or the environment (Esrey & Anderson, 2001). Frode-Kristensen (as quoted by Drangert, 1998)

reported that in Sweden urine was used to smear wounds and, to some extent, drunk as a therapy. Drangert (1998) also noted Hansen, who reported that in the Danish countryside in the 19th century urine was stored and used as a detergent for washing clothes and dyeing. In a fertiliser experiment on the growth of barley, using urine in parallel with manure, urine was examined as a fertiliser. The growth experiment showed that the urine had the expected fertilisation value (Jansen & Koldby, 2003).

A project conducted in Vaxholm, Sweden, in 2004 with the objective of achieving a system for the use of urine in agriculture concluded that it is possible for municipalities to organise stable systems for agriculture. The study also concluded that it is not a problem to find a use for human urine in agriculture, even in a large city in Sweden (Stintzing, 2005). The farmer's perception of the use of urine in Sweden is that the more concentrated the urine is the better it is from a farmer's perspective. They have found out in their study that establishment of a quality control system, such as certification of urine and other source diverted waste water fractions is extremely important for the use of fertilisers of organic origin in the Swedish context. Jönsson (2005) indicated in the guideline for the use of urine and faeces in crops that urine can be applied neat or diluted. They stressed that the application rate should always be based on the desired N application rate and the urine or urine mixture should be quickly incorporated into the soil, to minimise ammonia loss.

For hygienic measures, Schönning (2005) recommended that crops consumed raw should not be fertilised with urine closer to harvest than one month. In addition, there might be pathogens that may be present in the urine, thus requiring inactivation. According to Schönning (2005) the inactivation of pathogens in urine will be dependent on the pH (naturally increases to 9), concentration and temperature. She further clarified that dilution should be avoided for a more efficient treatment influenced by ammonia. It should be noted that the treatment she is referring to was mainly done in Nordic climates, thus recommending that adaptation of guidelines to tropical climates should be discussed.

In terms of how to apply urine in agriculture, Jönsson (2004) in his Swedish experiments found that it is better to mix the urine into the soil as quickly as possible. He indicated that the best method of doing this is by applying urine to farrows or holes, which have to be covered over immediately after application. The latter has been demonstrated in Mexico, in the Tepoztlán Municipality (Sawyer, 1998).

Simons and Clemens (2004) have tested urine as a fertiliser in barley in both field and greenhouse trials in Germany. Their trials found that the fertilising effect of urine was much higher than that of a mineral fertiliser. The study also showed no difference in yield between plots fertilised with untreated urine and acidified urine.

7.1.3 **Asia**

Esrey and Andersson (2001) indicated that the Chinese pharmaceutical industry used urine to make blood coagulants. They further highlighted anecdotal evidence from several locations that indicated that people preferred vegetables grow with urine fertilisation, and in China people were willing to pay more for vegetables grown in urine. Rooftop gardeners used only urine to grow vegetables such as tomatoes, cabbages, beans and pumpkins. Faeces were carted to the fields. Farmers have commonly used nightsoil, often untreated, to grow food (Esrey & Andersson, 2001).

In a pilot project in Kerala, India, urine from toilets was diverted into a growing area attached to the back of the toilet. Bitter gourds were grown, which were sliced, fried and eaten (Esrey & Andersson, 2001). In Manipur state, harvests of potatoes and chillies, when urine was used as fertiliser, were very good compared to harvests fertilised with chemical fertiliser, such as DPA, urea and potash (Singh, 2003).

In Sri Lanka urine was used for plants such as banana, coconut, vegetables, flowers or fuel wood. In Matale town, the Nandawathi family used urine and washwater to grow chillies, but only used the chillies after drying, not fresh (Calvert et al., 2002).

Getting people in Thailand to accept the application of human urine as a fertiliser was not easy. The main issue was the sociological difficulty, as the common belief is that human excreta are dirty and a pathway for disease transmission (Pinsem & Vinnerås, 2003).

Matsui, (1997, as quoted by Austin & Duncker, 2002: 66) mentioned the fact that farmers in Japan placed buckets at street corners in the towns and villages, collecting free urine from pedestrians and providing a simple public toilet at the same time.

In Nepal, the Environment and Public Health Organisation (ENPHO) has conducted experiments in the application of urine on various seasonal crops including potatoes, radishes and rice. The study concluded that there is a possibility of growing potatoes with the application of urine only. The experimentation on the other hand showed that higher yields of potatoes were reported with the application of chemical fertilisers than urine (Shrestha & Morgan, 1993). The study might be too early to draw conclusions from the study on the impact of urine on crops since, because urine application on crop yield can only be observed after several years of application and many crop cycles.

7.1.4 United States of America (USA)

Experiments in the USA found that maize, which was grown using substantial quantities of urine grew 50% taller than corn grown using no urine at all (BBC News, 2003).

7.2 Use of Human Faeces Internationally

Human faeces are not easy to handle properly as they contain many microbes that are hazardous to health (Matsui, 1997). Faeces can, if necessary, be processed in several steps before they are used. In a dry toilet with urine diversion, faeces are subjected to primary treatment, basically dehydration, which also effectively destroys most of the pathogenic organisms (Winblad, 1997). Health precautions require careful handling of faeces, if they are not dried or incinerated or buried in a pit.

It has been suggested that faeces should be sanitised before their application as a fertiliser (Jönsson et al., 2004). According to Schönning & Stenström (2004), faeces contain more pathogens than urine. A study by Peasey (2000) on the health aspects of the use of the content of a dry sanitation system showed that untreated or insufficiently treated faecal matter can pose a threat to human health. Therefore it has been suggested by Winblad (1996) that primary treatment either by dehydration or decomposition may be insufficient to destroy intestinal parasites and the author indicated that secondary treatment (e.g. high temperature) of vault contents may be necessary. Schonning and Stenström (2004) have recommended both primary and secondary treatment of faeces before returning them to the soil. They mentioned that

primary treatment is basically to reduce the volume and weight of faecal material to facilitate storage, while secondary treatment is for making faeces safe enough to return to the soil.

Human faeces contain mostly organic matter and phosphorus and potassium and thus serve as a soil conditioner and humus replenisher (Strauss, 2000 and Jönsson et al., 2004). Normally, lime or ash is added to faeces especially in the dry urine diverting toilets. Based on that, Jönsson et al. (2004) indicated that both ash and lime, which are normally added to faeces, increase the buffering capacity and the PH of soil, thus playing a role especially in soils with a low pH.

According to Jönsson et al. (2004), the plant availability of faecal nutrients is slower than that of urine. He argued that the reason for this is because large amounts of N and P originate from undigested matter and this matter needs to be degraded by the soil micro-organisms before the nutrients become available to plants. He further pointed out that, as the organic matter of faeces degrades, its content of organic N and P becomes available to plants. In addition, he indicated that the higher the concentration of P, K and organic matter in faecal matter the better it is for poor soils since it will increase the yield. Lastly, he pointed out a number of ways in which the organic matter can contribute to good and fertile soil (a) by improving the soil structure; (b) by increasing the water holding capacity and the buffering capacity; and (c) by serving as energy supply for the soil micro-organisms.

Jönsson et al. (2004) recommended that the application rate for faeces can be based on the current recommendation for the use of phosphorus-based fertilisers. He also recommended that faeces should be mixed into and covered by the soil before cultivation starts.

7.2.1 Latin America

The dehydrated faeces from LASF toilets built in Hermosa Provincia of El Salvador were used to reclaim wasteland and were used in a nursery garden. LASF (Letrina Abonera Seca Familiar) is a Spanish name for a double-vault dehydrating toilet with urine separation (Gough, 1997).

Strauss and Blumenthal (1990, as quoted by Austin & Duncker, 2002: 67) indicated that in Guatemala a mixture of decomposed, humus-like material of faecal origin and ash, called *abono*, was dried in the sun and then stored in bags upon removal from the vault, until the farmer used it in his fields at the time of tilling.

7.2.2 Europe

It became popular in rural Sweden to attach the latrine house (with no pit) to the stable, so that human faeces and dung from the stall-fed animals were mixed to make them less repulsive when applied to the fields (Drangert, 1998). In another study, the dehydrated faeces were composted together with household garbage for eight months before the product was used as soil conditioner in the residents' small gardens near the house (Drangert, 1998).

7.2.3 Asia

Calvert et al. (2002) mentioned that in Sri Lanka dehydrated or decomposed faecal material, which is an excellent soil improver, can be removed from a chamber and applied to plant beds.

Farmers from Bhaktapur (a historical city in the Kathmandu valley in Nepal) have been using fresh faeces instead of composted faeces in vegetable farming since ancient times. The tradition of using fresh faeces still continues but on a reduced scale. Though use of faeces in the field helps to replenish nutrients/organic matter, the health risks associated with handling could

negate the benefits of the increased growth. It seems that there was no knowledge of the nutrient content urine. If it were understood earlier, they would have been using urine as well, instead of using faeces only (Pokharel & Gajurel, 2003).

According to Furedy et al. (undated) South Asian cities have long been using human faeces in farming and aquaculture. According to them, this practice has been influenced by a number of factors like diversity of farming in and around cities, the large number of poor farmers, the scarcity and expense of chemical fertilisers and the peri-urban farmers' ready access to urban garbage. They indicated that human waste is applied to fruit and vegetable farms.

7.3 Use of Human Urine and Faeces (Excreta) Internationally

The use of sanitised human excreta as a fertiliser stimulates crop growth and, as a result increases nutrition for those who depend on subsistence farming, or helps to generate or supplement income for those who sell the products they grow. Human excreta are a rich source of nitrogen and other nutrients necessary for plant growth (Reed & Shaw, 2003).

7.3.1 Europe

Austin et al. (2005) noted that Schönning (2001) stated that in Swedish cities organised collection and transportation of latrine products to farmers had already started in the 18th century.

According to Drangert (1998), Reid reported in 1991 that "European artisans collected urine and canine excrement for industrial purposes".

7.3.2 Asia

Austin et al. (2005) quoted Schönning (2001), who reported that human and animal excreta have been composted for thousands of years in China. China has a long record of farmers collecting mixed excreta and applying it on their farms (Drangert, 1998). It seemed to be the only civilisation that has positively used human excreta as nutrients for agriculture, and even food for pigs, from its very earliest development (Matsui 1997). In the Guangxi province of China urine and faeces are used in fields to grow corn, rice and bamboo (Esrey & Andersson, 2001). The Chinese rely greatly on human excreta (sometimes known as 'nightsoil') as a fertiliser. Over 90% of the quantity collected is used in agriculture (Reed & Shaw, 2003).

Robson (1991, as quoted by Austin & Duncker, 2002: 66) reported that in China's city of Shanghai only 13% of the population had waterborne sewerage facilities. The Shanghai Bureau of Environmental Sanitation (SBES) collects the major part of the city's human wastes. The vacuum trucks of the SBES remove more than 8 000 tons of nightsoil each day from public toilets, septic tanks and nightsoil dumping stations. During the night the wastes are shipped by river and canal in sealed barges to depots on the outskirts of the city. There the waste is stored from 10 to 30 days in covered tanks, after which it is sold to farmers who applied it to their fields as manure.

Schönning (2001, as noted by Austin et al. 2005) noted that the recycling of urine and faeces was introduced in Japan in the 12th century. Farmers bought urine and faeces from town dwellers to apply it on their farms (Drangert, 1998). Cash crops such as vegetables and fruits were grown by suburban farmers using human excreta. Owing to Japan's closed policy, the country was not influenced by outbreaks of typhoid, cholera or other communicable diseases (Matsui, 1997).

Urine was used in India as fertiliser after storage, and faecal matter was composted with wastepaper and garden waste and used for soil enrichment. The toilet centre, which generated 200 tons of urine and 100 tons of faeces per year, produced 50 tons of compost, which in turn yielded 50 tons of bananas (Jenssen et al., 2004).

Ecosan has been practised for many generations in Nepal in different forms. Farmers have used excreta and urine separately for feeding pigs and for growing crops and vegetables for many years. The average household has "faecophobia" (i.e. they do not like to hear the word "excreta"), but a few farmers take raw (fresh) excreta from latrines to their vegetable gardens and grow good quality vegetables, which are tasty and highly in demand (Mishra, 2003). In the Sidhipur village, most of the farmers use animal manure and raw human excreta as fertiliser for crops and vegetables. They have been practising this since ancient days, although it was considered unhygienic by the villagers.

7.4 Use of Human Urine in Africa

7.4.1 Tanzania

Urine is now gradually being applied as a fertiliser in Majumbasita, Dar Es Salaam, Tanzania. A garden has been established at the school compound, and most of the parents and members of communities passing by have learnt the importance of urine as a readily available fertiliser. Some of the people divert urine into the shallow pit near a fruit tree or close to their garden. It could as well be applied in places with woody perennials that are fully grown to provide more than one significant contribution to the production and/or service functions of a land-use system (Chaggu & John, 2002).

Study gardens have been established in Majumbasita, Dar es Salaam, at Karakata Primary School and at individual homes to test the recycling of nutrients from EcoSan latrines. The plants in the gardens include eggplants, banana trees, cassava plants, etc. For comparison purposes, the gardens have been divided into two similar portions. Urine was applied to only one portion to determine its efficiency as a fertiliser (Shayo, 2003).

In the Kagera area in Tanzania, urine has been used as an antidote when somebody has inhaled and ingested poison, by giving that person fresh urine to drink. It has also been used as a pesticide to kill banana weevils (Chaggu & John, 2002).

Chaggu (2004) also mentioned that in Bukoba, Tanzania, the tradition of visitors was for visitors to urinate in the host's home garden, which was much appreciated and considered a gesture of respect. This practice has disappeared with the adoption of modern hygiene. She further quoted Missaar (1997) and Chaggu and John (2002) that, though excreta is plentiful everywhere, there is not much written about the subject of humanure (human excreta), and attempts to address this question in Tanzania have been mainly the result of difficulties faced in terms of a high water table.

7.4.2 Zimbabwe

Morgan (2003) reported on trials performed on varieties of vegetables and maize using urine diluted with water at a ratio of three parts water to one of urine as a liquid feed. Seedlings were planted in containers (buckets or cement basins) and irrigated with water first, to stabilise them in their new environment, and thereafter with a water/urine mix. This was compared with similar

vegetables and maize irrigated with water only. After a specified growing period, the crop was harvested and weighed. The yields of the vegetables and the maize irrigated with the urine/water mix were the highest. The trial revealed the great value of urine when used as a liquid feed for various plants, and particularly for leafy vegetables (lettuce, spinach, covo – a type of spinach). There is huge potential for urine application as an enhancer of vegetable and crop growth.

A study conducted in the informal settlement of Hatcliffe extension in Harare, Zimbabwe, revealed these findings (Guzha, 2001):

- 61.3% of the households said they would not use urine as a fertiliser because they thought it would burn crops.
- 17.5% said it had a bad smell
- 55% said they did not know that it could be used.
- 11.3% said urine is a good fertiliser.
- 12.5% said they would use urine because fertiliser was expensive.

Studies on people's attitudes on excreta use have been carried out in urban and rural areas, specifically in the Marondera and Zvishane districts, with interesting findings covering traditional human excreta reuse, attitudes toward crops grown using human excreta, fears, myths and taboos on excreta use. A few respondents said urine had medicinal properties or could be used as a pesticide. Others indicated that urine has traditionally been used as medicine in the treatment of athlete's foot, sore eyes, impotence, burns, runyoka (illness caused by having sex with someone else's wife) and as a love potion (Guzha, 2004).

7.4.3 Botswana

Eighteen of the 24 families in Paje used urine for fertilising purposes; some as trials to learn the new concept while others used fresh overnight urine on trees and flowers. However, experience in the village showed that people in general reacted unfavourably towards the use of urine and treated faecal matter as a fertiliser and soil conditioner. A reason for the rejection might be found in education and tradition. Urine is something to keep out of one's own terrain. There is also a strong belief that urine and faecal matter are something very dirty. The consideration that it could be very valuable after treatment is quite erroneous in Tswana understanding. On the other hand, there are also superstitious reasons for the negative attitude; for example, a widespread belief in witchcraft, which holds that urine as a substance could be harmful. Even the fear of spreading HIV/AIDS through the use of urine in the garden was mentioned (Hanke, 2003).

Pilot trials for the agricultural use of urine were identified as the most important follow-up step towards encouraging responsibility for one's own toilet products, and for demonstrating their fertilising potential. Trials were conducted whereby three plots were prepared in each of 16 locations. One was fertilised with urine, the second one with urine and compost, and the third one without any kind of fertilisation for comparison purposes. In all the cases the plots were planted with spinach (Swiss chard). After a certain period, the best results were achieved with the use of compost and urine together. This resulted in participants starting to use urine after the demonstration, and even those without toilets started to collect urine for further use (Hanke, 2003).

With the use of urine and compost, the nutrient supply is more balanced than with the use of urine alone, resulting in a higher yield. Another important aspect recognised during the research was the different level of acceptance of using urine directly as opposed to pouring it on the

compost and then using it in the garden. The indirect use seems to be easier to accept (Hanke 2003).

A paper presented at the Ecosan Conference in Durban, South Africa by Bolaane and Tiroyamodimo (2005) pointed out that in a few instances urine has been and is being used in backyard gardening. Experiments for urine fertilised vegetables were conducted in West Hanahai and Paje. However, composted faecal matter is not yet used, pending further sampling for pathogenic content.

7.4.4 Ethiopia

Sundin (1999), as noted by Jönsson et al. (2004), indicated that urine has been tested as a fertiliser on Swiss chard in Ethiopia. The yields of the fertilised plots were up to four times those of the unfertilised.

7.4.5 Mali

Urine has also been tested as a fertiliser on cotton and sorghum in Mali and results are promising (Jönsson et al. 2004 cited Dembele, personal communication).

7.4.6 Uganda

An ecosan project carried out in Kampala showed that 22 farmers have been identified and agreements signed with them to carry out demonstrations and trials on their farms. These farmers will be involved in the plot demarcation and decision making on the types of crops to be grown. The plots will be about $9m^2$ and the first trials will be conducted with urine, since urine is more acceptable than faeces for the farmers to use. The demonstration areas will study the physical changes in plants given the application of urine. In another season more trials will be conducted to test the quantity of urine per period, the concentration of urine applied to crops, the application of urine with other organic fertilisers and project structure. One of the challenges experienced in this study was the unacceptability of using faecal products (Project management unit members: Kampala Ecosan Project, 2005).

7.4.7 Nigeria

Traditions in Nigeria prohibit collection of urine by strangers for fear that the urine may be used against the people through ‘black magic’ or ‘evil spirits’ (Sridhar et al., 2005). There is still a phobia of using urine for growing edible crops (Sridhar, et al. 2005 cited Sridhar, 2003). In a study carried out in Ibadan, South West Nigeria, urine was collected from a tertiary institution - the Federal Polytechnic, Ede in Osun State - and the contents used for growing the most popular edible crops. The test crops grown were a fruit-yielding Okro (Hibiscus esculentus), Tete (a green amaranth), Amaranthussp (a leafy vegetable) and maize (Zea mays), a cereal demanding high N inputs. In the greenhouse experiments, plant height and number of leaves were recorded as indicators of growth. In the case of okro, urine performed better than the other treatments. For green amaranth, while urine is comparable to organo-mineral fertiliser (OMF), the NPK chemical fertiliser has performed better. In the case of maize, urine was comparable to OMF and NPK (Sridhar et al., 2005).

On the acceptability of urine-grown crops, initially about 73,1% of the community felt that urine is a body waste and may have pathogens, and therefore should be disposed of in the conventional way. Only 7,69% accepted that vegetables and other crops could be grown using urine as fertiliser. Once the experiment was completed the community members were taken around the farm to see for themselves the quality of crops obtained. All the respondents were surprised to see the yields obtained from urine, which was found to be much better and fresh in appearance,

and they believed that urine is a good alternative for fertiliser. About 80% of the respondents showed a willingness to build a urine-diversion toilet on their premises (Sridhar et al., 2005).

7.5 Use of Human Faeces in Africa

7.5.1 Burkina Faso

A field experiment has recently been started in Burkina Faso where dried faeces are being used as fertiliser on trees such as mango and banana. A shovelful of faeces is mixed in with the soil in the pit just before the planting of each tree. No results are available as yet (Jönsson, et al. 2004 cited Klutse, personal communication).

7.5.2 Nigeria

The study carried out by the Akinyele local government of Oyo State, Nigeria, indicated that the majority of the respondents (head of farming households) had very poor toilet systems. About 18% built pit toilets while only 2% had water closet systems. It was found that that the respondents used the bush and farm lands to defecate. They feel that nothing is wrong with that, as their culture permits it. The respondents engage in cultivation of different types of cash crops for home consumption and for income generation to sustain their large families. These crops include cassava, yam, maize, cocoyam, cocoa, bananas, fruits and leafy vegetables. Almost all respondents (99%) do not have access to fertiliser due to its high cost (Nikuru, 2005).

More than half of the respondents (64%) believe that it is possible that human waste (excreta) can enrich the soil nutritionally, 52% of the respondents had used human waste on their farms before, not because they had applied it, but because of the culture of indiscriminate defecating on every farm and in every bush, 69% of the respondents believed that it makes crops grow better, and 60% accepted that they could use human waste on their farms as manure if the smell was reduced. There was a positive relationship between experience in farming and use of human waste on the farm. That means that only these respondents who have been farming for many years are aware that human waste can enrich the soil, and that is probably why they allow it on their farms (Nikuru, 2005).

7.5.3 Uganda

Windberg et al. (2005) conducted experiments by establishing ecological sanitation demonstration gardens using sanitised materials. With the resultant harvest, the stigma of the taboo on these materials has reduced greatly and is evidence that materials are better recycled than disposed of. Crops grown using faecal manure have been found to be of better quality and with a higher yield than crops grown on the control plots. The project has demonstration gardens at its headquarters in Kabale, at the Kyera Agricultural training farm in Mbarara, Kisoro and in the Rukungiri districts.

From the interviews conducted regarding the use of faecal matter, Windberg et al. (2005) revealed the following:

- The majority of the respondents stated the production of manure was one of the three main reasons for their decision to accept ecosan toilets.
- Knowledge about the agricultural use of faecal material is more widespread than knowledge about the use of urine as fertiliser. Often the urine of animal and human origin is used as insecticide.

- None of the interviewees at household level expressed any doubts about eating food fertilised by nutrients of human origin. However, in-depth interviews suggested that there was a considerable resistance towards this.
- Farmers without ecosan toilets showed interest in using the faecal material as manure.

7.5.4 Zimbabwe

The results of the study conducted in Hatcliffe extension in Harare, Zimbabwe, showed that some community members ate sweet potatoes planted where people used to dispose of their faecal matter, and these did not taste as good as those planted using ordinary manure. This finding was not conclusive, since other factors might have influenced the taste. However, 66.3% of the households interviewed said they put the faecal manure in their fields or gardens, 13.8% said they used it for tree planting, and only 8.8 % said they threw it away. They threw away the manure because they either did not want to use it or they had no plot in which to apply it. Twenty four households (out of 80) were not using faecal manure for the following reasons (Guzha, 2001):

- 11 said the manure was not treated.
- 6 said they had no knowledge on safe use.
- 4 said they did not want to handle faeces.
- 2 said they had no garden.
- 1 felt the manure might cause diseases.

Studies on people's attitudes on excreta use have been carried out in both peri-urban and rural areas in Marondera and Zvishavane districts with interesting findings regarding traditional human excreta use, attitudes toward crops grown from human excreta, fears, myths and taboos towards excreta use. Some of the interviewees stated that defecating on someone's property is seen as a taboo, faeces should be disposed of as far as possible from the household and should never be tampered with. An enemy can use one's faeces to bewitch one, therefore, individuals should be careful on how and where they dispose of their faecal matter (Guzha, 2004).

7.6 Use of Human Urine and Faeces in Africa

7.6.1 Burkina Faso

In Burkina Faso mango trees are fertilised with faeces at the time of planting and doses of urine are regularly applied during the growth season (Jönsson et al., 2004).

7.6.2 Uganda

Experience from Kalungu Girls Secondary school in Masaka District, showed that faeces (including anal cleansing material and ash) are collected in locally produced wooden containers which are changed regularly and brought to a covered composting area for drying before reuse in the surrounding banana and matoke plantation. Urine is collected in jerry cans and reused as fertiliser (Mülleger & Lechner, 2005).

7.6.3 Ghana

The study carried out in Nima, a mostly low-income suburb of Accra, Northern Ghana, revealed that respondents perceived the reuse of urine and faecal matter as positive towards achieving urban household food security, and that they would support the implementation and its sustenance. The practical part of this was not discussed (Tsiagbey et al., 2005).

7.6.4 **Kenya**

In Kenya, the “neem” tree *(Azadirachta indica),* which has many valuable properties, as well as citrus trees, grew well on the arborloo pit (Morgan, 2003). The Arborloo refers to a simple, low cost, shallow pit toilet where the toilet slab and structure are portable and moved from one pit site to the next at about one yearly intervals. It is a method that involves recycling nutrients by growing trees in shallow pits. Both urine and faeces are deposited in a shallow pit. When it is nearly full, it is topped off with soil and allowed to digest and decompose for several months. At that time trees are planted in the top soil. Guava, banana, mulberry and pawpaw respond very well and grow very fast. Avocado, mango and citrus grow more slowly initially. All these fruit trees supply valuable micro-nutrients to consumers (Esrey & Andersson, 2001).

Morgan (2001) discussed the traditional African method of recycling human waste – also known as the arborloo. It is a method of planting valuable trees in old abandoned latrine pits - a method which is established in countries such as Rwanda, Kenya, Malawi and India. A wide variety of indigenous trees also responded positively. This technique was most suited to places where there was space to plant trees. It is becoming popular in countries like Mozambique, Malawi, Zambia, Rwanda, Kenya and Zimbabwe, and is being tested in South Africa. The fact that it is so widely practised means that it is logical and acceptable from the users’ point of view (Morgan, 2001).

In a study carried out in Nakuru municipality in Kenya, Otieno & von Münch (2006) pointed out that only an average of 9% and 15% respectively of the total respondents had knowledge of UD toilets and use of human waste as fertiliser, suggesting a very low public awareness of ecosan options. On the other hand, there were a high proportion of people with a positive outlook towards the use of treated waste as fertiliser, which was very encouraging (over 65% of all respondents expressed a willingness to consume products grown on sanitised human waste. Only 18% of the respondents were unsure or voiced cultural taboos and health fears as concerns (Otieno & von Münch, 2006).

7.6.5 **Ethiopia**

Edstrom (1999, as noted by Austin & Duncker, 2002: 69) indicated that the FAITH (Food Always In The Home) gardening practice is based on vegetable gardens divided into sections that are planted in rotation, at intervals of a few weeks. Thus, while some patches are producing food, others have seed still germinating providing a constant supply of available food. The vegetable patches are well composted with human “manure” and any other suitable organic material, such as garden refuse. Excellent results were obtained.

7.6.6 **Malawi**

Morgan (2001) shared the experience of the ecosan work undertaken by Mbachi Msomphora in Malawi regarding the use of excreta as fertiliser. The planting of bananas on old, full pit latrines was commonly practised in Malawi, both in the rural areas and also in peri-urban and urban areas where pit latrines were used. Some farmers also successfully grew other crops like paw paws, granadillas, tomatoes, pumpkins and a variety of leaf vegetables. Some farmers, practicing urban agriculture in Lilongwe and Blantyre, collected sewage from the disposal site for fertilisation of their plants or gardens. Since consumption of fruits and other crops grown from human waste was seemingly widely accepted in Malawi, the promotion of the arborloo, where old pits are used as planting grounds for crops, was seen as a good practice which would be effective.

Certain tree species known as “Cham’mwamba” *(Moringa oliefera)* and “Mtumbu” (*Kirkia acuminate)* were also shown to grow well on abandoned full pit latrines. The trees were used for various household purposes, such as shelter and making poles for fencing and roofing. Leaves from Cham’mwamba trees were also used for food, namely okra. Leaves from Mtumbu trees were used for making dyes for dyeing woven baskets. Timber could also be obtained from Mtumbu trees. A farmer demonstrating this had several stands of these tree species around his homestead. He had future plans of planting fruit trees. (From Ecological Sanitation in Malawi by Mbachi Msomphora, WaterAid, Salima, 2001).

Planting citrus trees is popular amongst owners of the arborloo in Malawi, although banana, mango, mulberry and pawpaw trees may be more successfully grown. Gum trees also grow well (Morgan, 2005).

7.6.7 Zimbabwe

A wide variety of fruit-bearing trees grew very well in the ‘arborloo’ system. The findings of a research project, conducted in Mondorela district, indicated that households and schools agreed to use the urine and composted faeces as crop fertiliser and soil conditioner for maize and fruit trees. Households with completed sanitation structures were already harvesting the excreta and had started to apply urine to fruit trees using one part urine to ten parts water (Muduma, 2003). The participating households already identified crops they wanted to experiment with: 80% of the households said they wanted to plant maize, 6.7% said they wanted to experiment with Okra, 6.7% said they wanted to experiment with beans, and the remaining 6.7% said they wanted to experiment with pumpkins. Ten households started to harvest both urine and faeces for use on their plots. The project demonstrated to the community that urine and composted faecal matter, if properly applied, have a high plant nutrient value almost equal to that of commercial fertilisers (Muduma, 2003).

Morgan (2003) also reported the findings of experiments carried out in Zimbabwe, using the *Fossa alterna* method, which involved recycling nutrients by making humus in shallow pits. In a series of simple experiments vegetables like spinach, covo, lettuce, green peppers, tomato and onion were grown in soil in 10-litre buckets/basins in Epworth and Ruwa (areas with exceptionally poor topsoil) and their growth was compared with plants grown in similar containers filled with a 50/50 mix of Epworth or Ruwa soil and *Fossa alterna* soil. The results showed a dramatic and meaningful increase in vegetable yield resulting from the enhancement of poor soil (Epworth and Ruwa) with the *Fossa alterna* humus. In other trials, maize and other seedlings were reported to have done well too.

Morgan (2003) indicated that tomatoes, flowers and a wide variety of trees (which can be started off in jars) grow very well in a system called “skyloo” used in Zimbabwe. In a “skyloo”, a urine diversion pedestal is mounted over a single vault and the faeces fall into a 20-litre bucket, followed by a mixture of soil and wood ash (mix 4:1). Urine is diverted to a plastic container. The bucket of faeces, soil and ash is allowed to fill up and is then transferred to a “secondary composting site” which may be a shallow pit, trench or jar, where more soil is added.

The findings of the study conducted by Guzha (2001) in Dzivarasekwa extension in Zimbabwe revealed that most of the residents said they could not use human excreta for growing vegetables as they were uncomfortable eating vegetables they knew had been fertilised from human manure. Other community members said they would use excreta for planting flowers, maize and fruit trees. However, urine was used as a fertiliser.

Measurement of harvests from different treatments showed that a combination of human faeces (humanure) and urine (ecofert) assures a farmer of a good return from his capital investment because of good yields. The analysis also indicated that using humanure and ecofert improves the water productivity in maize production under rain-fed agriculture considerably (Guzha et al., 2005).

7.6.8 Mozambique

The possibilities for excreta use were studied in two small towns in the Niassa province of Mozambique. The province is primarily an agricultural area and most people (both males and females) who participated in the study were farmers. Nine of the families interviewed stated that they would use the resulting compost from ecosan in their fields in the future. Two of the families said they would not use the compost because it was a very new idea. Due to the novelty of ecosan for people in Niassa, it was felt that time was needed for them to change their attitudes. Follow-up work still needs to be done with families who are using the compost, in order to ascertain their opinions. This information could then be used to help change the attitudes of people who are not using the compost on their fields (Dos Santos & Breslin, 2001).

The *Fossa alterna* method of recycling nutrients in excreta has been successful in Mozambique under a programme supported by WaterAid. In this programme a portable slab and twin pits are used within a single permanent superstructure. Every year approximately 600 litres of fertile humus is formed in the composted pit and this can be used on vegetable gardens (Morgan 2003). The *Fossa alterna* method requires people to remove the decomposed faeces and apply it in their fields. The *arborloo* is usually used at seasonal farming locations for growing fruit trees in orchards. So far, cultural acceptability has not been a problem.

Breslin (2003) quoted Breslin & Dos Santos (2001) on the findings from the sanitation work undertaken by ESTAMOS. He highlighted that ESTAMOS has learned that many families in Niassa, and particularly in places like Mandimba and Lichinga, were already planting trees, pumpkins, and a range of vegetables like tomatoes on abandoned pit latrines (as mentioned above, the planting of banana trees on disused pit latrines is a common practice in neighbouring Malawi). These products were eaten without reservation, although people were reluctant to talk about the practice in public gatherings. The consumption of agricultural products grown on abandoned pit latrines strongly suggests that cultural concerns regarding food grown with human excreta were not grounded on the reality of community practice in Niassa (Breslin & Dos Santos 2001).

Linked to the above is the acceptance of a small number of arborloos at family agricultural plots in Niassa. Farmers understand that a shallow pit latrine, which will be used for the three or four months that a family lives on their ‘machamba’ (agricultural field), can be used productively by planting a tree on the pit as the family gets ready to return to its permanent home. The idea of fruit orchards at family machambas is slowly growing in some parts of Niassa. In an environment where access to agricultural products like soil conditioners and fertilisers is limited, farmers throughout Niassa experiment with, and use, a variety of materials for compost, including organic materials like animal faeces (particularly goat), and at times human excreta. The use of human excreta for agricultural purposes is not widely discussed for a range of cultural reasons, but is evident in a number of places where ESTAMOS and WaterAid are working (Breslin 2003).

ESTAMOS also made use of an agricultural demonstration plot by planting a guava tree in an arborloo. The results were impressive as the guava plant outgrew older guava plants on the

farm within a period of six months. Farmers showed interest in arborloos, but the agricultural station is unfortunately now closed. Some residents of Niassa were using human compost from an EcoSan latrine on small vegetable plots within a family's yard, and others were also considering the Arborloo in their main fields outside town (Breslin, 2003).

Breslin (2003) mentioned the comments of one user of the Arborloo: "*I now have a latrine (Arborloo) in my machamba. During the agricultural season my family can use this latrine, which is an improvement on our situation in the past. But what is most important is that we can plant a young tree there at the end of each harvest. This means that in the future we will have many fruit trees because we will make a new pit each year and plant a new tree when we are finished for the year*."

Using human compost for agricultural purposes is gaining momentum in Mandimba and Lichinga. The excavated compost was taken to an ESTAMOS agricultural plot where field trials were being run with the Department of Agriculture to test how different vegetables responded to human compost. In another incident in Lichinga, on seeing the compost, which smelled like dirt and did not resemble human excreta at all, the owner said: "*This is incredible. I was worried about this but now I do not have any fear about the compost. I will tell everyone about this*" (Breslin, 2003). However, few people have said they thought the use of excreta was culturally unacceptable. Instead, many families insisted that it was simply logical.

Use of compost as well as ecofert for growing vegetables and gardening have been reported in some communities and in one primary school in Búzi and Dondo; however, this use is not programme guided and has therefore not yet been monitored (Macário & Fogde, 2005).

7.6.9 Botswana

Jenssen (2004) reported that in the villages of East and West Hanahai, located in Botswana's Kalahari Desert, on-site sanitation facilities allowed the families to produce their own soil conditioner and fertiliser for their vegetable gardens.

7.7 Use of Human Urine and Faeces in South Africa

Human excreta are generally perceived as dirty and are not used in South Africa. However, a study conducted by the CSIR revealed that human faeces have been used in earlier times for various purposes. Some of the respondents said that wet faeces were used to heal wounds. They were also applied to the skin of a person bitten by a snake, to remove the poison. This practice was known to only a few people who participated in the survey. Women who used cow dung to plaster the floors also used babies' first urine of the day to wash their hands, prior to working on the cow dung. It was believed that this practice cast a spell to avoid one's hands being handicapped. This is no longer practised, but urine is used to treat eye infections, though on a minimal scale (Duncker & Matsebe, 2004).

7.7.1 Eastern Cape Province

A number of urine-diversion toilets were built in a pilot project in communities near Mthatha (previously Umtata). Faeces were collected in separate wooden or plastic containers in the chamber beneath the pedestal; and were rotated when full. The villagers were aware of the soil conditioning properties of desiccated faeces and disposed of them in their maize fields and vegetable gardens. They did not use urine; this was piped into shallow soak pits instead (Austin & Duncker, 2002).

7.7.2 Northern Cape Province

In Kimberley faecal matter was regularly collected from households with ecological sanitation systems for composting at a communal facility. The partly dehydrated faeces were worked into the soil, after paper, plastics, etc. were removed. Various crops were grown. In Hull Street, Kimberley, an entrepreneur mixes the faeces with horse dung and turns the heap regularly. After a period of time, some of the households fetch the co-composted material and use it as soil conditioner. About 10% of the gardens are planted with bushes, trees and flowers. After a garden competition held in 2005, interest in gardening has risen (Drangert et al., 2006).

Austin & Duncker (2002) reported that use of human excreta was not practised in most other communities in the Northern Cape and the desiccated faeces were simply burned inside the chamber, together with the used cleansing materials. Both faeces and urine were seen as waste products, even though the users were aware of the fertiliser value of faeces. Babies' urine was used to treat eye infections by the older people; however, this is not practised any more.

Human faeces and urine were regarded as unpleasant by the people and they are unwilling to handle human faeces to use in their gardens. The handling of human faeces is generally not acceptable, either as a general norm, or as a result of conditioning through health and hygiene campaigns. Even though most respondents were aware of the fertiliser value of faeces and some of urine, only a few respondents were willing to use faeces in their gardens. In most cases the urine was piped to the soak away built alongside the UD toilet, because most users were not aware of the fertiliser value of urine and were convinced that it would kill the plants. The general belief in the Northern Cape is also that it is unacceptable to eat vegetables grown in human faeces because they are unclean. Most people had flower gardens and lawns, but still did not want to use excreta in these. The conclusion is that they did not want to be seen using human faeces in their gardens, as handling human faeces was unacceptable (Duncker & Matsebe, 2004).

7.7.3 North West Province

The findings of a survey conducted in Taung, North West province, showed that users of urine-diversion toilets in the area were aware of the value of faeces for agricultural purposes. Some indicated that they would use faeces in their gardens when they emptied the vaults of the toilets, but others were not willing. However, handling of faeces was a problem in most of them (Duncker & Matsebe, 2004). The majority of respondents said that they did not ascribe any cultural values, beliefs or taboos to human faeces or urine. However, there were general feelings that touching or handling excreta, especially faeces, should be avoided.

Men and women in general also felt that the handling of excreta was unacceptable, apart from when babies and sick people in the home needed help to manage defecation. In these cases, women were seen as the caretakers and were conditioned to accept these tasks, while the men distanced themselves totally. Both faeces and urine were mainly seen as waste products, even though the users were aware of the fertiliser value of faeces and indicated that they would use it in their gardens. Babies' urine was used to treat eye infections and minor ailments.

The fact that human faeces and urine were regarded as unpleasant by the users was a reflection on the willingness of people to handle human faeces and eventually use it in their gardens. The handling of human faeces was generally not accepted in North West province, both as a general norm, and as a result of conditioning by health and hygiene campaigns. Most respondents were aware of the fertiliser value of faeces and some of urine, but some were only

willing to use faeces in their gardens. In most cases, the urine was piped to the soak away that was built alongside the UD toilet, as most users were not aware of the fertiliser value of urine, and were convinced that it would kill plants. The general belief was also that it was unacceptable to eat vegetables that were grown in human faeces because they were unhygienic. The households indicated that they were willing to use the dry faeces in their gardens, but still did not want to eat vegetables grown in it (Duncker & Matsebe, 2004).

7.7.4 KwaZulu-Natal

KwaZulu-Natal had the most UD toilets (more than 50 000) built in South Africa. Even though eThekwini Municipality, which implemented the UD sanitation projects, did not advocate the use of the products from the UD toilet, most respondents were aware of the fertiliser value of faeces. However, the majority were not willing to use human excreta at all. Those who had no objection to using human excreta were willing to use faeces in their gardens, but not urine. Men and women in general also felt that the handling of excreta was unacceptable, apart from when babies and sick people in the home needed help to manage defecation. In these cases, women were seen as the caretakers and were conditioned to accept these tasks, while the men distanced themselves totally. Some respondents also worried that they could be infected with the HIV/AIDS virus if they handled human excreta (Duncker & Matsebe, 2004).

7.7.5 Western Cape Province

A number of urine diversion projects were implemented in rural settlements in the Western Cape Province, as well as in an informal settlement (Khayelitsha) near Cape Town. Unfortunately the experiences and results of these projects have not been documented.

7.8 Cultural views regarding human excreta

Attitudes and perceptions about health hazards, and people's revulsion from faeces and urine, vary between cultures, and often people's attitudes towards urine differ from those to faeces (Drangert et al., 1997). Drangert et al. (1997) quoted Tanner (1995) indicating that every social group has a social policy for excreting; some norms of conduct will vary with age, marital status, sex, education, class, religion, locality, employment and physical capacity. Drangert et al. (1997) noted Hanafi (1995) stating that a Koranic edict considers urine to be a spiritual pollutant, and Islamic custom demands that Muslims minimise contact with human excreta. They also mentioned that urine has been shown to have a disinfectant property.

Drangert et al. (1997) reported that faeces are perceived quite differently and are regarded as offensive and unpleasant to handle. They also indicated that both professionals and laymen have strong opinions that adult faeces are hazardous to health because they may contain a variety of pathogens. He also noted that Tanner and Wisjen (1993) said that faeces may carry a definite cultural meaning - for example, that one's faeces can be a medium for revenge and therefore must not be seen by others, or that the faeces of certain kin must not be mixed. A good example is the baseline KAP (knowledge, attitudes and practices) survey conducted by the Mvuramanzi Trust in the densely populated informal settlements near Harare, which showed that urine has been used for medicinal purpose in the treatment of earache, athlete's foot and bed wetting. It has also been used as an important ingredient in the preparation of love potions (Guzha, 2001). A study conducted in Mozambique showed that many people in Lichinga believe in various forms of witchcraft. One common way to bewitch a family is to place 'medicine' in someone's toilet. This is a cause for concern among those who intend to use the transformed excreta for agricultural purposes. Although it is rarely talked about, many seem to fear the insertion of 'bad medicine' in their latrines by an angry visitor (Breslin, 2003).

A study in peri-urban Eldoret in Kenya indicated that 10% of the respondents thought it unsafe to throw children's faeces into the latrine, as it (children's stools) should not be mixed with those of adults. Children's faeces should be hidden because of the danger of a witch picking up the stool of a particular child, and faeces left in a shallow latrine can be picked up by people with ill will (Drangert et al., 1997).

Cow dung seems to be less offensive than human faeces. It became a popular practice in Sweden to attach a latrine house (without a pit) to the stable, so that human faeces and dung from the stall-fed animals were mixed to make them less repulsive when applied to the fields. A similar practice was conducted among Tallensi farmers in Sweden using human faeces and animal manure as fertiliser. Another common way to get rid of human faeces is to let pigs and dogs eat the faeces and produce their own faeces, which are not regarded as repulsive as human faeces (Drangert et al*.,* 1997).

Drangert et al. (1997) noted that Reid (1991) reported the professional pride exhibited by Parisian sewer men. They also noted the South African example of the Bhaca ethnic group in the Transkei, where members are eagerly sought after as attendants at sewage treatment works. On the other hand, according to the same source, highly qualified Transkeians are reluctant to work in the sewage treatment field. A possibly contrasting example is given by Tanner (1995:90, as noted by Drangert et al., 1997) who mentioned the social position of lavatory cleaners: "*In Hinduism, it is done by outcasts, but much the same status applies to cleaners in western societies*". They also noted that Hösel (1987) stated that in ancient Rome the cleaning of the Cloaca Maxima was performed by prisoners of war. They inferred from these statements that the general perception of human waste was one of disgust. However, the organisation of waste disposal was highly regarded, and led by one of the most prestigious officials in the Roman Empire. Farmers in Sweden expressed positive attitudes to the use of human urine on their fields; tenants believed in recirculation, but the property managers preferred to wait for initiatives from the tenants (Drangert et al., 1997). They also noted Botta et al. (1997) who reported in Swedish on a study conducted at the eco-house in Norrköping, which included residents' perceptions of the no-mixing toilets. According to Drangert et al. (1997), Botta (1997) also found that the no-mixing toilets were appreciated by both women and men (even though men would need to sit when urinating).

8. RESEARCH FINDINGS

The results and the findings of the field research are presented below according to the sections in the interview schedule.

8.1 Background of Target Settlements

8.1.1 Augrabies, Northern Cape Province

The settlement of Augrabies is situated near the Augrabies Falls National Park and Kakamas, about 160 km west of Upington in the Northern Cape Province. The Augrabies area has the life-giving Orange River running through it and, as a result, all the activities and agriculture lie along its fertile banks. The area is famous for its grapes and, in particular, raisins. The hot and dry climate is perfect for soft fruits, which are irrigated from the series of primitive canals, driven by ancient water wheels. The average rainfall per year is quite low (less than 150 mm/year) compared to the rest of South Africa. The settlement is mainly inhabited by the Griekwa people and San people who speak Afrikaans and dialects of the San language.

8.1.2 Mthatha and Buffalo City, Eastern Cape Province

Mthatha (Umtata) is situated in the Eastern Cape Province, about 300 km north-west of East London. The first pilot project on urine diversion sanitation in South Africa was implemented in three villages around Mthatha in 1998. These villages (Sinyondweni, Manyosini and Gwebindkundla) are mainly inhabited by Xhosa-speaking people.

Scenery Park forms part of Buffalo City, which is the municipal area of East London in the Eastern Cape. It is a township situated about 20 km from East London and mainly inhabited by Xhosa-speaking people and a few Afrikaans-speaking coloureds. The Integrated Environment and Sustainable Development unit of the municipality piloted a urine diversion toilet project in the eco village located on the periphery of the township near the informal settlement area. UD toilets have been installed in eight units. The sanitation systems in the area include waterborne, pit toilets and urine diversion toilets. The residents of the informal settlement have no toilets and use the bush. Residents are aware and have knowledge of urine diversion from the awareness raising workshops conducted in the area.

8.1.3 Kwa-Shozi, KwaZulu-Natal

The intention of the researchers was to access villages in the eThekwini Metro area, where a huge number of urine diversion toilets had been built. However, the municipality felt that enough research was being conducted by other organisations and themselves in these areas and that more research by yet another organisation would confuse the household members, especially as the municipality had not focused on the reuse of nutrients from the products of the toilets when they started their projects. Therefore, the researchers selected a village (Kwa-Shozi) on the border of the eThekwini Metro that was also very close to another village where urine diversion sanitation had been implemented.

Kwa-Shozi is a sparsely populated rural area about 50 km south of eThekwini (formerly known as Durban), and inhabited by Zulu-speaking people. It is part of the eThekwini Metro, situated on the border of the eThekwini and the Ugu district municipalities, with Amanzimtoti as the nearest town. The majority of the residents in the area use pit toilets, a few households use waterborne/flush systems, and only one household has urine diversion sanitation. The residents had obtained some information about urine diversion toilets from neighbouring villages.

8.1.4 Madombidza, Limpopo Province

Madombidza village is situated approximately 15km south of the town of Makhado (previously known as Louis Trichardt) in the Limpopo Province. Makhado is well known for its game farms. The area is bordered by the Soutpansberg Mountains on the west, and rich in a variety of vegetation, from sandveld and vlei to savannah, and even includes fynbos on the upper mountain peaks. The region is well known for its agricultural diversity, which ranges from tropical and sub-tropical fruit and nuts, to cattle and game farming.

The main language spoken in the village is Tshivenda. DWAF subsidised the first Ventilated Pit Latrines (VIPs) during the first phase of the RDP3/4 Sanitation Programme. The first phase was mainly the construction of a demonstration VIP in each of the 71 villages that formed part of the RDP3/4 Programme. To date, 162 VIP latrines have been constructed in the Madombidza village since 1997.

8.2 Respondents

8.2.1 Gender of respondents

The gender split of the respondents in the field research was 75% female and 25% male. This was due to the fact that, when the research was conducted, the female household members were more readily available during the day (being at home, not having a day job) while the male household members were away at work. Also, 28% of the households were headed by women (female-headed households). The range of ages is depicted in the interview schedule (Annexure B and C).

Figure 2: Gender of the respondents

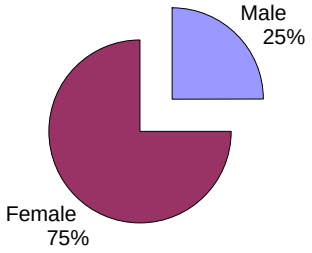
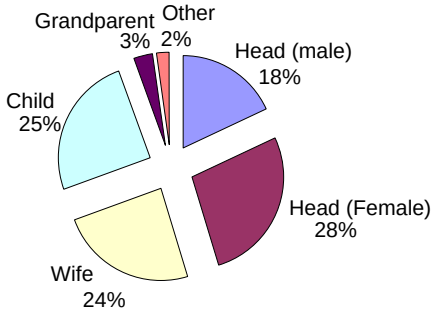


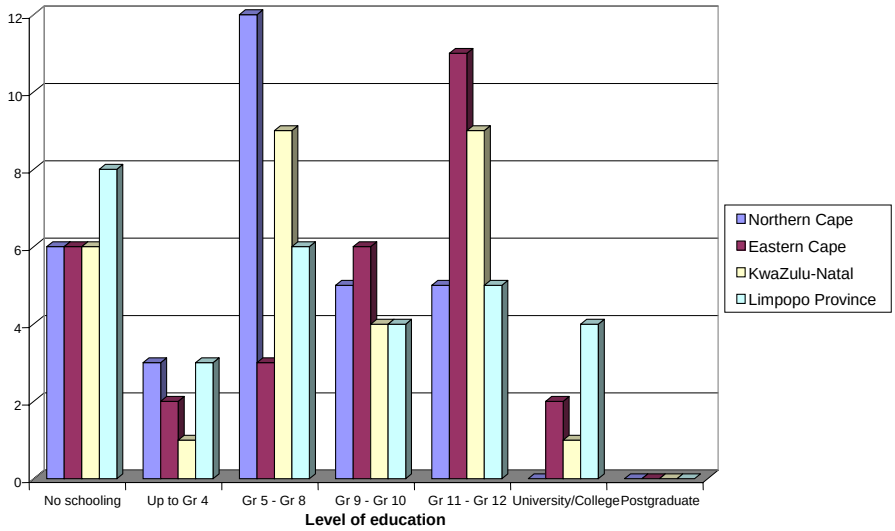
Figure 3: Position in household of respondents



8.2.2 Respondents' level of education

The level of education of the respondents varied from province to province. Most of the respondents had finished either primary school or high school. Only a small number (7 = 0.5%) of the respondents obtained higher education at colleges in their respective provinces. Respondents older than 56 years in general had obtained no formal education (26 = 20%) and could not read or write.

Figure 4: Level of education of respondents

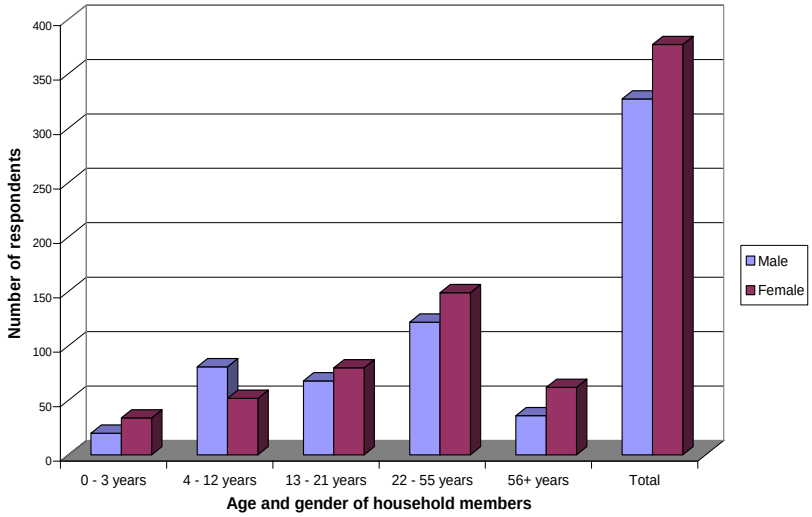


8.3 Household Information

8.3.1 Age and gender

The households consisted mostly of members between the ages of 22 and 55 years, the majority of whom were female. However, the children in the households between four and 12 years old comprised more males than females.

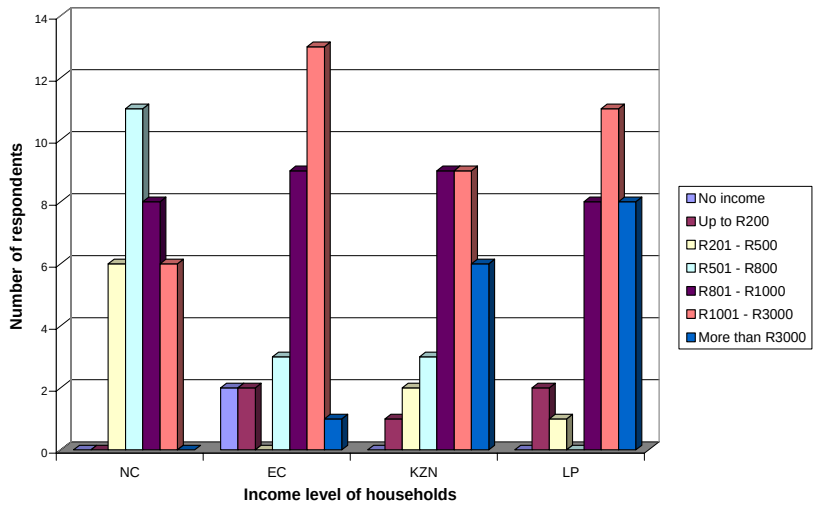
Figure 5: Age and gender of household members



8.3.2 Average income

All the households that were interviewed had some source of income. The general level of income in all the provinces was above R800 per month. More households in KwaZulu-Natal and Limpopo than in the other two provinces indicated an income of more than R3 000 per month.

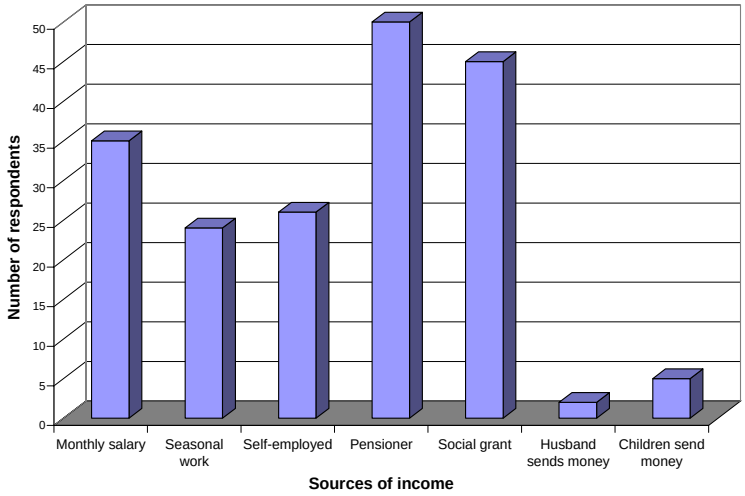
Figure 6: Average income of households



8.3.3 Sources of income

The majority of the income of the households consisted of pension money, grants for children and disability grants. The monthly pension paid out was R850 per month, a child grant was R190 per month and disability grant was R850 per month.

Figure 7: Sources of income of households



'Self employment' was defined as earning money from piece jobs or selling products/produce from a tuck shop on an irregular basis. A monthly income was defined as a salary paid on a monthly basis in a permanent job. 'Seasonal work' was defined as working in the vineyards during harvest time from September to March each year.

All the households interviewed had more than one source of income. Most of the households (89%) were dependent on pension money and social grants (child grant and disability grant), while only 26% of the households had a permanent source of income through a monthly salary.

8.4 Nutrition

8.4.1 Gardens

All the households in KwaZulu-Natal and Limpopo had gardens and fruit trees. Most of other households also had gardens and fruit trees, apart from seven (23%) in the Northern Cape and Eastern Cape, which did not have any form of garden or any fruit trees. The main reason provided by these respondents was that they had enough money to buy produce from the shops or the market and did not need to have a vegetable garden.

The households in the Northern Cape were aware of the water scarcity in their region, but did not see it as a reason for not having a garden as they had either street taps or yard taps as a water source for the household. Only two respondents said that they did not have gardens because of the water scarcity. The others who did not have gardens said that they were either too old to tend to gardens or did not have the money for seeds to start a garden. The households in the Northern Cape did not have maize fields but grew grapes, while the households in the other three provinces had maize fields but did not grow grapes.

Figure 8: Gardens

Picture 1: Vegetable garden in Augrabies (NC)

Picture 2: Vegetable garden in Manyosini (Mthatha, EC)

All the gardens were situated inside the boundaries of the households' yards, except for three households in Limpopo where their maize fields were situated in a communal area.

Picture 3: Vegetable garden in Kwa-Shozi (KZN)

Picture 4: Vegetable garden in Madombidza (LP)

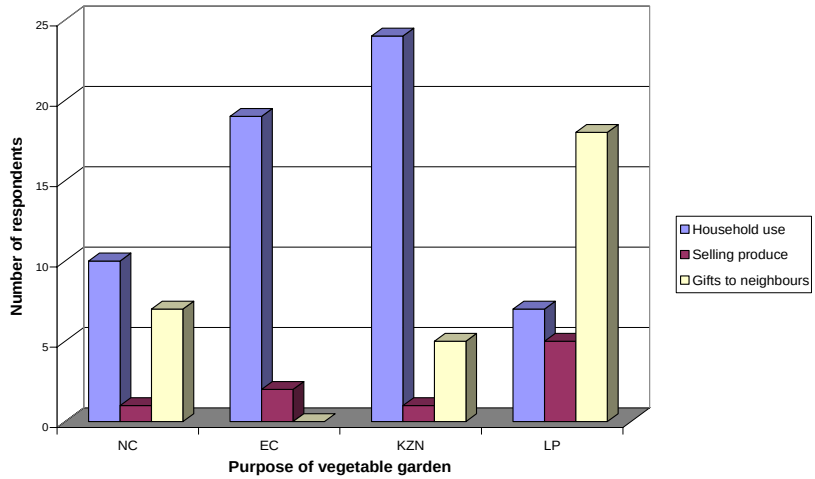
The water sources for the gardens were mainly rainfall (51%), street taps (16%) and yard taps (25%). Only one household in KwaZulu-Natal used water from a stream and 6% in Limpopo used water from boreholes for their gardens. The rainfall in the Northern Cape is very low, therefore the households mainly use water from their yard taps and street taps for their gardens. Grey water from the households was used only unintentionally for the gardens, by occupants throwing it out on the lawn or the fruit trees.

8.4.2 Purpose of vegetable gardens

The purpose of the vegetable gardens was mainly to provide produce for use by the households themselves. Therefore, most of the gardens were only big enough to provide for that household. The gardens featured in Pictures 1, 2 and 4 were the few that were bigger than the norm in the settlements. Picture 3 shows the average size of the gardens in the target settlements.

Some households, especially in Limpopo, used produce from their gardens as gifts for their neighbours. Only nine households (7%) in total made an income from selling some of the produce from their vegetable gardens to others.

Figure 9: Purpose of vegetable gardens

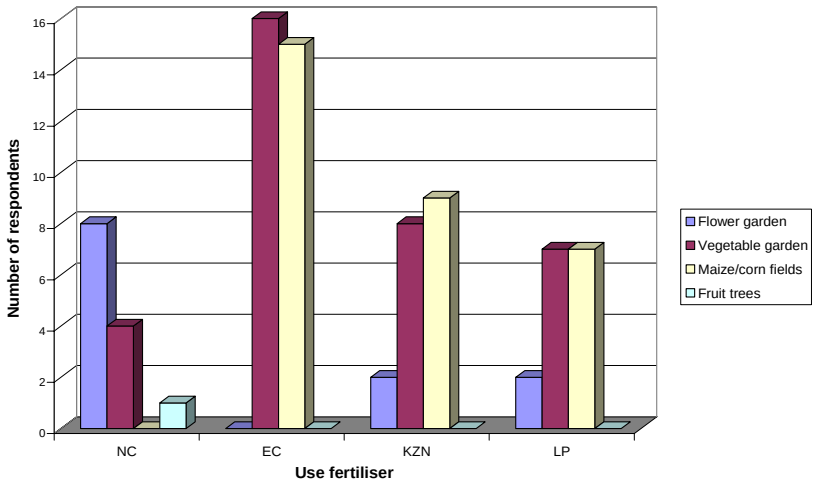


8.4.3 Use of fertiliser

Some households (53%) in the Eastern Cape used some kind of chemical fertiliser for their vegetable gardens and maize fields while fewer households (26%) in KwaZulu-Natal and Limpopo used fertiliser for their flower and vegetable gardens as well as their maize fields. Some households in the Northern Cape (23%) used fertiliser for their flower and vegetable gardens as well as their fruit trees.

Organic fertiliser was also used, and consisted of animal (pig, goat, cattle) manure that was obtained from their own or from neighbours' animals. Only two respondents from the Northern Cape mentioned that they made their own compost with vegetable peels, leaves, animal manure and rusted tins that they buried in the ground and used at a later stage as compost.

Figure 10: Use of fertiliser in gardens

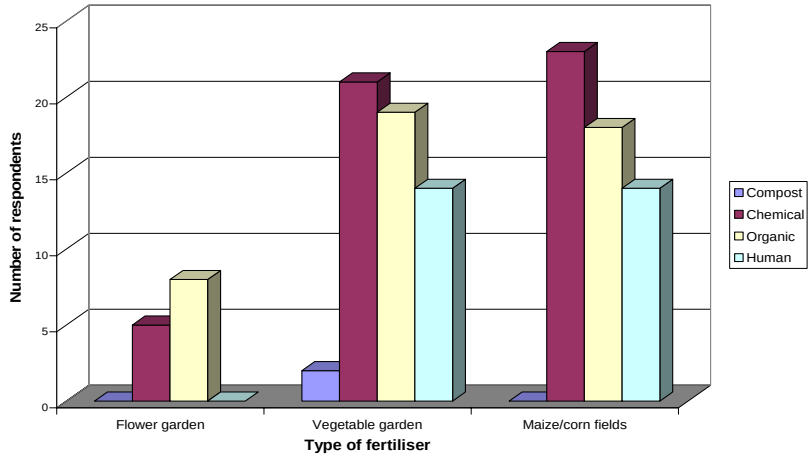


Picture 5: Fertiliser used in Augrabies (NC)

Mainly chemical fertiliser was used, which was bought at nurseries or obtained from farmers or, in the Northern Cape, from vineyards.

The average cost of fertiliser ranged between R20-00 and R100 for different sized bags. Households spent, on average, R80 on fertiliser only when necessary – sometimes once a month of once in three months.

Figure 11: Type of fertiliser used



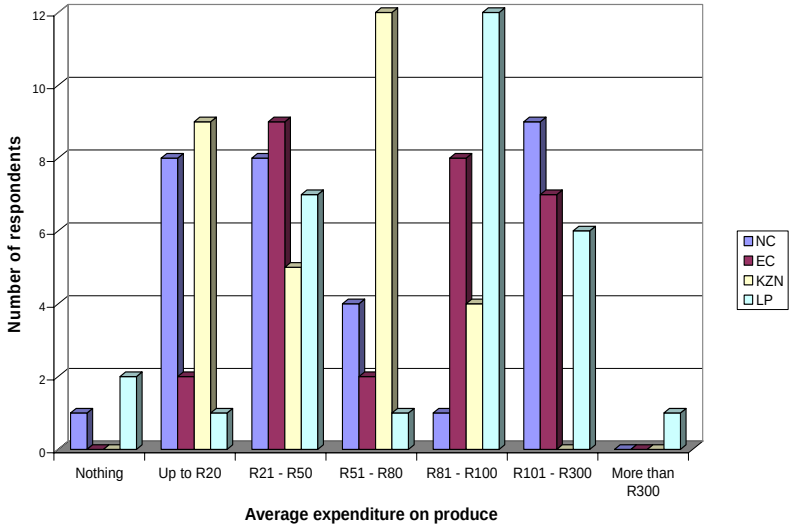
None of the respondents in the Northern Cape used human excreta as soil conditioner or fertiliser for their gardens.

Most of the respondents (88%) in Mthatha in the Eastern Cape mentioned that they used human faeces for their vegetable gardens and maize fields. These households have been using urine diversion sanitation for eight years and accepted the technology completely.

Those respondents in Limpopo and KwaZulu-Natal who did not use urine diversion toilets said that they would be willing to use human excreta as fertiliser if they had access to it through the urine diversion sanitation system. These households had never used urine diversion toilets before; they had only heard about it. The practice of using human excreta for their gardens was therefore still hypothetical.

8.4.4 Expenditure on produce

Figure 12: Expenditure on produce



The households spent between R20 and R300 on produce per month, depending on the size of the households. The produce was obtained from shops, or from vendors driving through the areas, or in some instances from neighbours who had vegetable gardens.

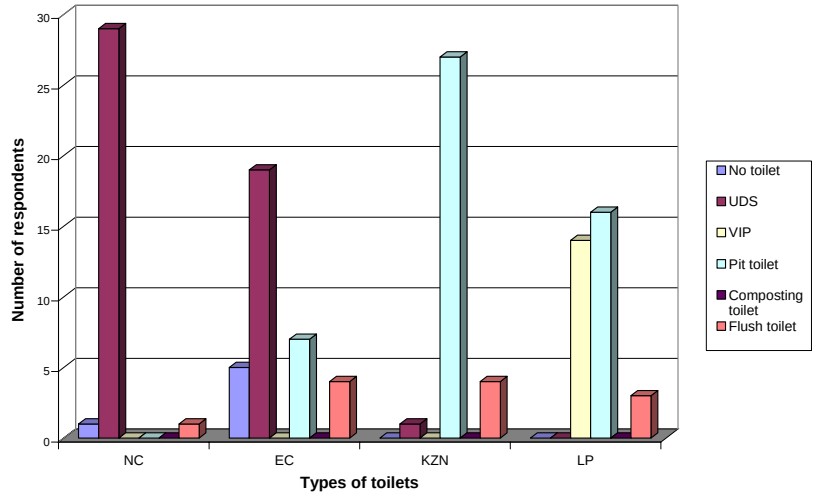
8.5 Sanitation

8.5.1 Types of toilets

A variety of toilets were used by the respondents. The households in the Northern Cape and Eastern Cape provinces used mainly urine diversion (UD) toilets. A few households (7) still used the old pit toilets together with the UD toilet, and four households had flush toilets. Four households did not have any kind of toilet because the household members were still young and/or had just moved into the area and were still busy settling down and building a house and toilet.

The households in KwaZulu-Natal used mainly pit toilets while three households had flush toilets. Only one household used a UD toilet. In Limpopo Province, 46% of the households used ventilated improved pit toilets (VIP) toilets, 53% used ordinary pit toilets and three households had flush toilets.

Figure 13: Types of toilets in the yards of the households

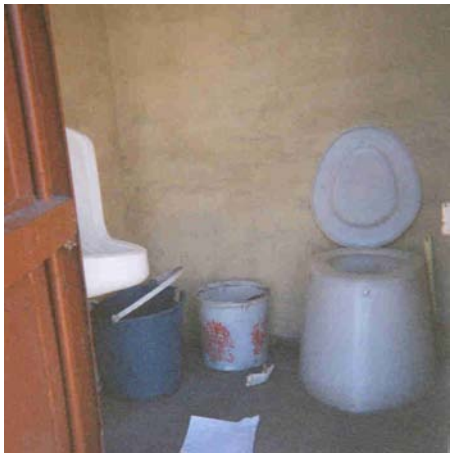


The households in the Northern Cape and Eastern Cape provinces were beneficiaries of sanitation projects implemented by their municipalities through implementing agencies. Therefore these households felt that they did not make the choice of toilet themselves; they could only receive the planned toilet through these projects.

Picture 6: UD toilet in Augrabies (NC)

Picture 7: Inside of UD toilet in Augrabies (NC)

Picture 8: UD toilet in Sinyondweni (Mthatha) with a pit toilet in background



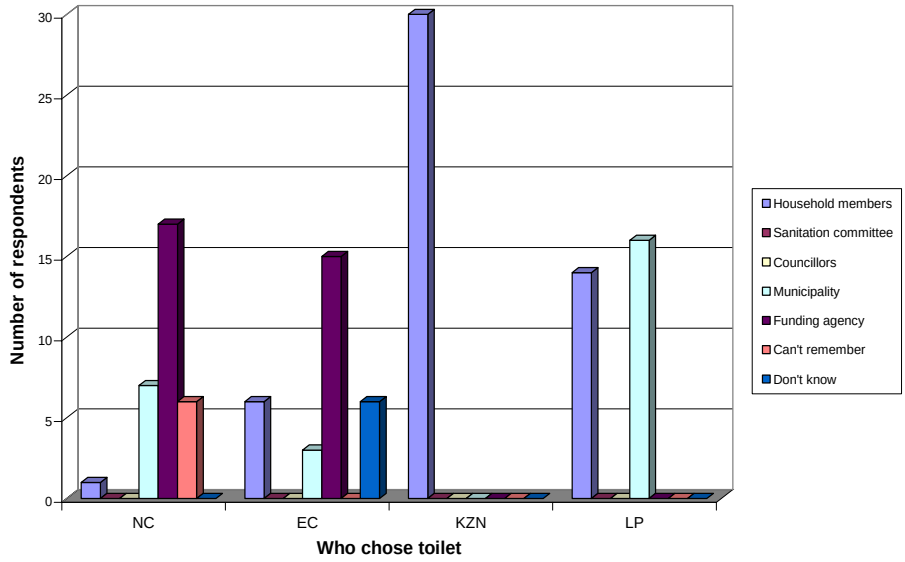
Picture 9: Inside of UD toilet in Sinyondweni (Mthatha)

Picture 10: Double vault UD toilet in KZN

Picture 11: Pit toilet in Kwa-Shozi (KZN)

Pictures 12 and 13: VIP toilets in Madombidza (LP)

Figure 14: Choice of toilet type



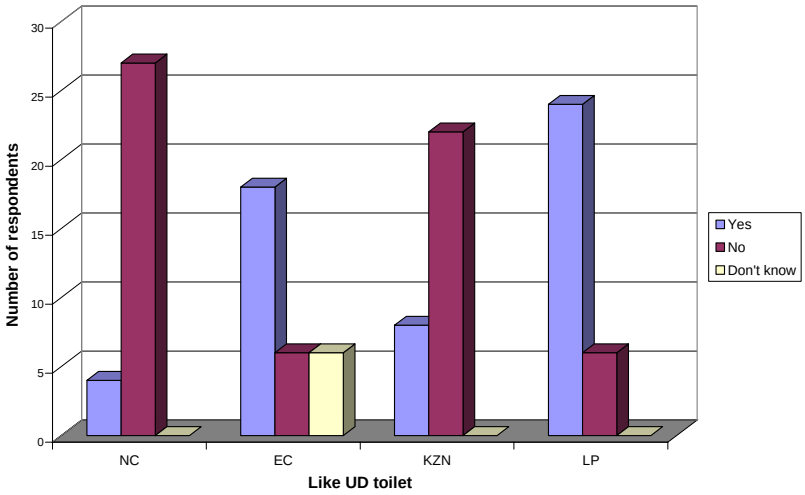
The households in KwaZulu-Natal and Limpopo used pit toilets that they had built themselves, and therefore had chosen themselves. In Limpopo, VIP sanitation projects were implemented by the municipalities and in these cases the households felt they had not made the choice themselves.

All the households that were interviewed wanted to have flush toilets, namely water-borne sanitation.

8.5.2 Liked the UD toilet

The responses to the question on whether the people liked the UD toilet varied in terms of how long they had been using the UD toilet, as well as the level of knowledge regarding the UD toilet.

Figure 15: Respondents who liked UD toilet



The households in the Northern Cape had been using the UD toilets for more than three years. They said that they no longer liked the UD toilet because these toilets had been badly constructed; the superstructure, toilet pedestal and doors had started falling apart and breaking. The pipes used for the diversion of the urine were also too small, which resulted in blocked pipes leaking into the vault and creating a smelly cesspit full of flies and cockroaches, instead of a dry chamber. The covers over the vaults were also sealed with mortar, which made them very difficult to remove and reseal when the vault had to be emptied.

Picture 14: Sealed vault in Augrabies (NC)

Picture 15: Cockroaches from a UD toilet in Augrabies (NC)

The households in Mthatha in the Eastern Cape had been using their UD toilets since 1998 and still liked them. These toilets were very well constructed and were still in very good condition. The households had also been well trained in their operation and maintenance and regular follow-up visits after implementation addressed any problems experienced. Most of the "no" and "don't know" responses in Figure 15 for the Eastern Cape originated from households in Scenery Park, Buffalo City, which did not have UD toilets yet. Their sanitation project was still in the planning stage and, therefore they could not respond to the question.

Picture 16: UD toilet in Sinyondweni (Mthatha, EC)

Picture 17: Handwashing facility at a UD toilet in Sinyondweni (Mthatha, EC)

The households in KwaZulu-Natal were from a neighbouring village where UD toilets had been built by the eThekwini municipality. Their knowledge of UD toilets was obtained from discussions with household members of the neighbouring villages who were using these UD toilets. The majority of the households (73%) said they did not like the UD toilet from what they had heard and seen in the neighbouring villages.

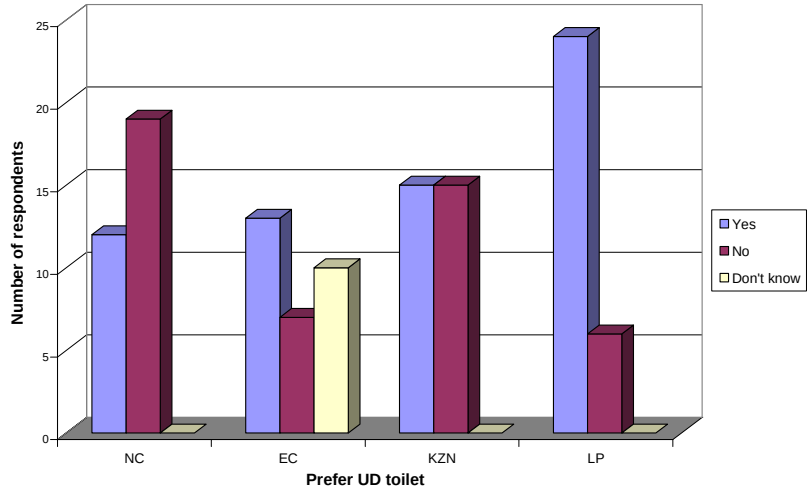
The households in Limpopo had no exposure to UD toilets or the concept of ecological sanitation. The main features of the UD toilet were explained to the households and 80% of them replied that they would like the UD toilet because any toilet would be better than the old and smelly pit toilets they were using at that stage.

Picture 18: Pit toilet in Kwa-Shozi (KZN)

Picture 19: VIP toilet in Madombidza (LP)

Only half (53%) of the households said that they would prefer the UD toilet above any other (apart from a flush toilet). However, 63% of the households in the Northern Cape were disillusioned and disappointed with the condition of their UD toilets (see 8.5.2) and preferred to go back to using their old pit toilets again.

Figure 16: Prefer UD toilet



8.6 Perceptions of Human Excreta

The perceptions of people regarding human excreta varied from province to province.

8.6.1 Cultural meanings

In the Northern Cape only two households attached a cultural meaning to human faeces - namely when one was bitten by a sand gecko one should eat one's own fresh faeces to avoid dying. The other households in the Northern Cape did not attach any cultural meanings to either human faeces or human urine.

In the Eastern Cape 63% of the households said that human urine could be used as protection against witchcraft, and 23% said that human faeces could be used to bring bad luck to the household.

In KwaZulu-Natal 33% of the households said that human urine could be used to treat snake bites and 1% said that human urine could be used against evil spells. The households in KwaZulu-Natal did not attach any cultural meanings to human faeces.

In Limpopo Province only three households (1%) attached cultural meanings to human faeces and urine; these were to mix human faeces with other traditional medicines to attract customers if one is a traditional healer (sangoma), and to mix it with other traditional medicines for preventing babies from getting diseases especially when coming from a funeral. Also, giving human urine to toddlers to drink would help them to start walking.

It seems that cultural taboos and cultural meanings attached to human urine and faeces are not great factors in the implementation of urine diversion sanitation, as only a few households mentioned it in three of the four provinces. However, in the Eastern Cape these cultural taboos and meanings are still important to the households and need to be considered in implementing urine diversion sanitation strategies and projects.

8.6.2 Perceptions of human urine

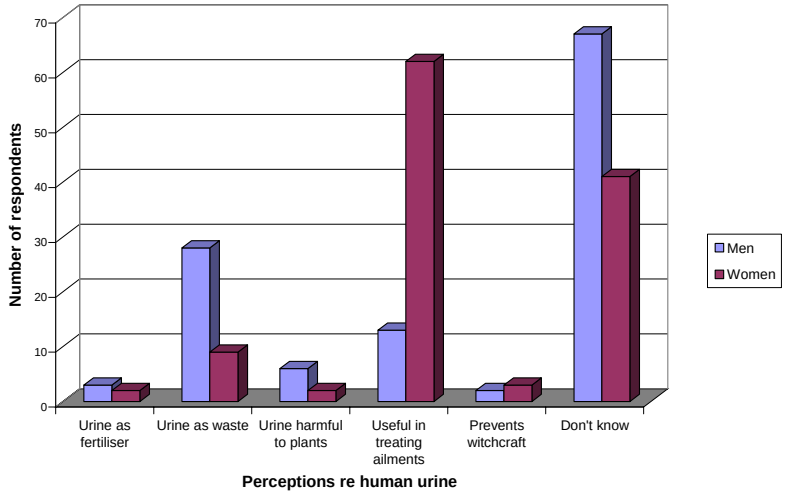
Men and women in all the households interviewed had different ideas and perceptions regarding human urine. Only five households interviewed were aware of the fertiliser value of human urine.

Women (51%) regarded human urine as very useful in treating ailments such as swollen ankles and feet, burns from the fire, eye infections and spots on the skin. Only nine women regarded human urine as useless and two said it was harmful to plants.

Men in general did not have much of an opinion regarding human urine; 55% said they thought nothing of it and 23% regarded it as useless. Only 1% said human urine was useful in treating ailments because they had seen the women using it.

This is a good indication of the fact that men regarded sanitation as a women's issue; therefore they did not pay much attention to issues concerning urine.

Figure 17: Perceptions of men and women regarding human urine



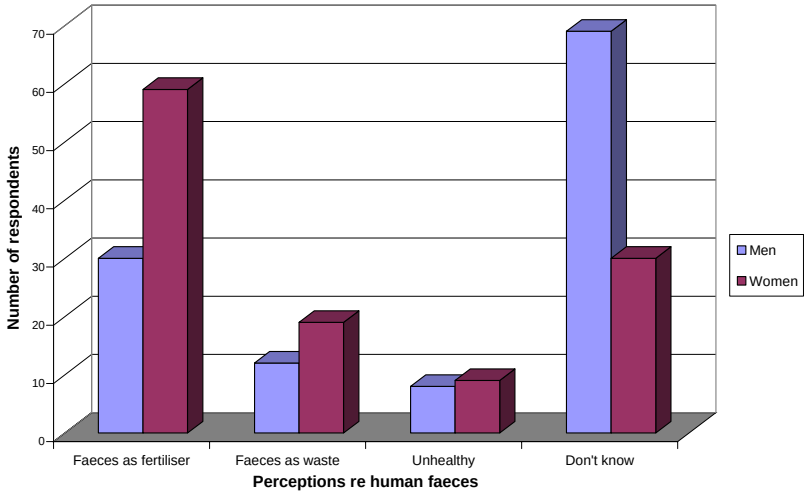
8.6.3 Perceptions of human faeces

Men and women in the households interviewed also had different ideas and opinions regarding human faeces. More women (49%) than men (25%) were aware of the fertiliser value of human faeces.

In the case of human faeces, 57% of men did not have much of an opinion, while 10% said it was useless and 6% said it was unhealthy.

This is again a good indication of the fact that men regarded sanitation as a women's issue.

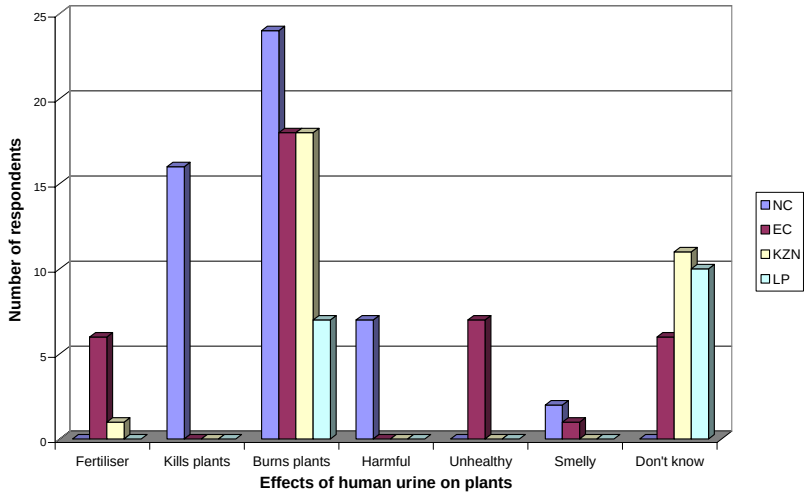
Figure 18: Perceptions of men and women regarding human faeces



8.6.4 Perception of the effects of human excreta on plants

According to 55% of the respondents, human urine was harmful to plants as it burned and killed the plants. Only seven households said human urine was a fertiliser for plants.

Figure 19: Perception of the effects of human urine on plants

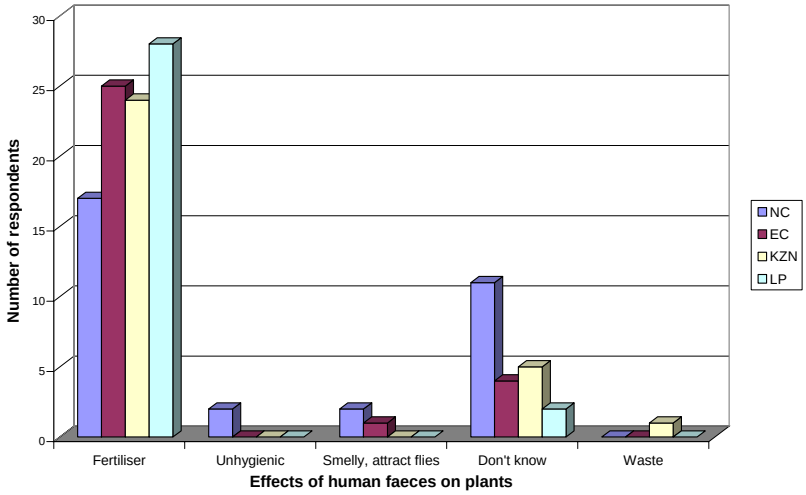


Pictures 20 and 21: Pot plants watered with urine dilution in Augrabies (NC)

In Limpopo 43% of the households said urine prevented termites from eating plants.

The majority of the households interviewed (78%) said that human faeces could be used as fertiliser for plants, but still no one used it in their gardens (see 6.4.3). A small number of households (4) thought human faeces to be unhygienic and smelly, and therefore it will attract flies.

Figure 20: Perceptions of the effects of human faeces on plants

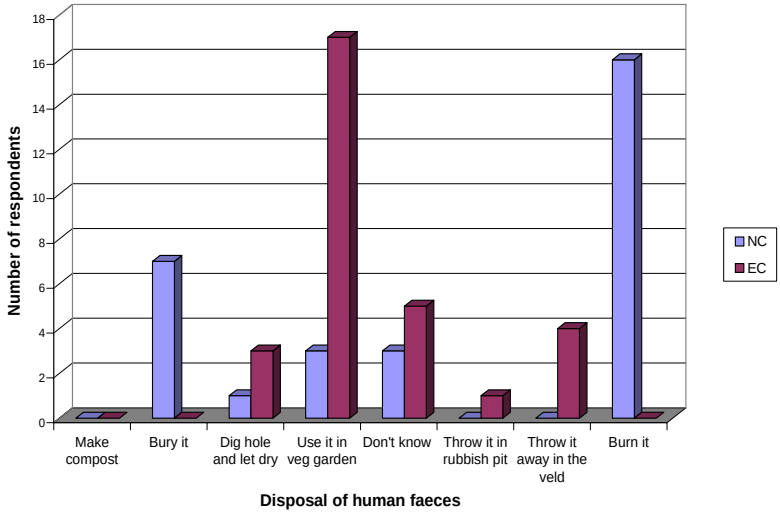


8.7 Use of Human Excreta

8.7.1 Disposal of human excreta

All the households interviewed that had UD toilets disposed of human urine in a soak pit, or in the pits of the VIP and pit toilets. The faeces from the vaults were disposed of by the households of the Northern Cape and Eastern Cape provinces in the following ways:

Figure 21: Disposal of human faeces



Only the households interviewed in the villages around Mthatha in the Eastern Cape said that they used human excreta as fertiliser for their maize fields (see Picture 22 and 23 on the following page).

Picture 22: Human excreta being removed from vault in Mthatha (EC)

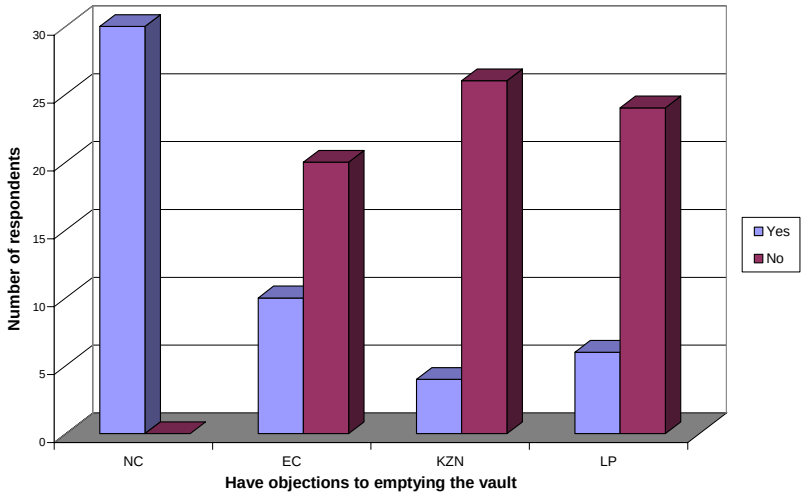
Picture 23: Human excreta being mixed with ash and soil in Mthatha (EC)

None of the other households interviewed used human excreta as fertiliser or to make compost for their gardens, even though 78% said it could be used for this purpose (see Figure 20).

8.7.2 Objections to emptying vault

Almost two thirds (58%) of the households in the four provinces did not have objections to emptying the vault of a UD toilet. This could be ascribed to the fact that the households in Buffalo City in the Eastern Cape, KwaZulu-Natal and Limpopo did not have UD toilets and did not have any experience of emptying the vaults.

Figure 22: Objections to emptying vault



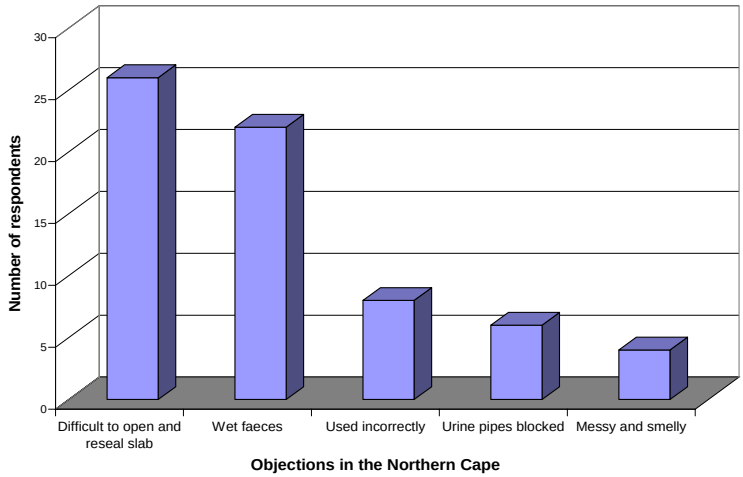
The households in Mthatha in the Eastern Cape had to empty their vaults, but the contents were mostly dry (see Picture 24); therefore they did not have objections. The few who did said that their major objection was that they thought it was unhygienic to handle human excreta and that it was too much effort.

The households in the Northern Cape had to empty wet and smelly contents from their vaults owing to bad construction, blocked urine pipes and lack of maintenance of the UD toilets (see Picture 25). They clearly stated that they had major objections (see Figure 22) to emptying the vaults.

Picture 24: Dry contents in vault of UD toilet (Mthatha) in Eastern Cape

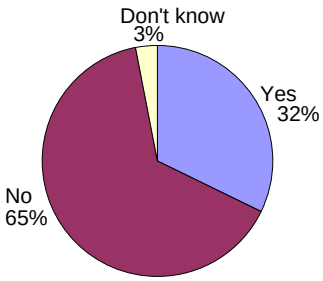
Picture 25: Results of blocked urine pipes in a UD toilet in Augrabies (NC)

Figure 23: Objections to emptying the vault in the Northern Cape



8.7.3 Collection/disposal service

Figure 24: Want collection/disposal service



Almost two thirds (65%) of the respondents said that they did not want a collection/disposal service for the contents of their UD toilets and did not want to pay for it. Some (20%) of the respondents in the Northern Cape said that the households should be paid for the fertiliser they provide to whoever wanted it.

The 24% of the households that were willing to pay for a collection service, said they would be willing to pay between R10 and R50 per month.

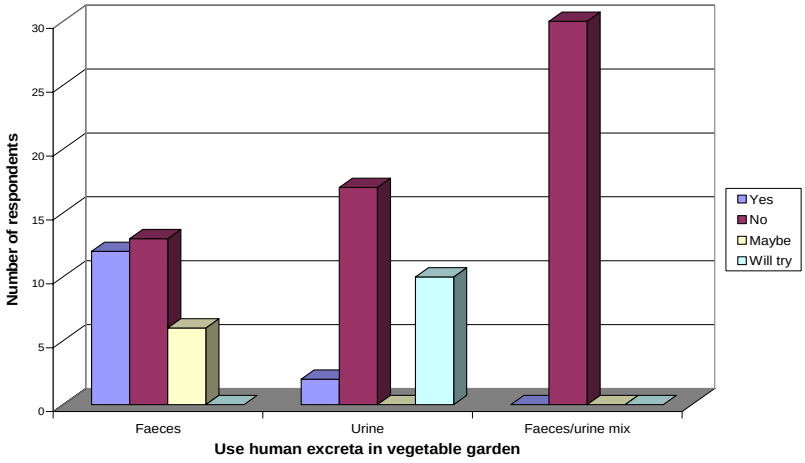
8.8 Willingness to Use Human Excreta

8.8.1 Use human excreta in vegetable gardens

The responses from the households interviewed regarding their willingness to use human urine and faeces in their vegetable gardens differed from province to province as a result of the extent of exposure to urine diversion sanitation.

Respondents in the Northern Cape were willing to use human excreta in their vegetable gardens as they had already been using urine diversion toilets for more than three years and were aware of the fertiliser value of human faeces. When informed that human urine was also a fertiliser the respondents said that they would try using human urine in the vegetable gardens to see if it worked. The respondents were not willing to use mixed urine and faeces in their vegetable gardens since owing to the bad construction and maintenance of the UD toilets, the contents of the vaults were wet and smelly (see Picture 25) and no one wanted to use the sludge in their gardens.

Figure 25: Use of human excreta in Northern Cape



The main reason provided by those who did not want to use human excreta in their vegetable gardens was that using human excreta was considered “unhealthy” as well as “smelly”.

Figure 26: Reasons for not using human excreta in vegetable gardens in the Northern Cape

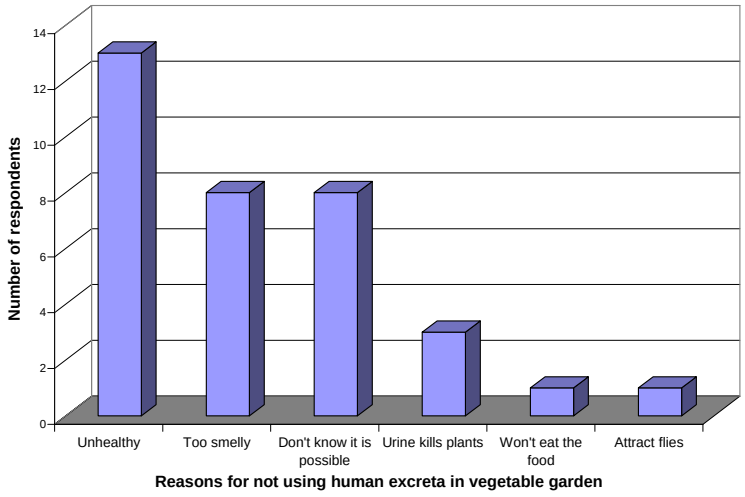
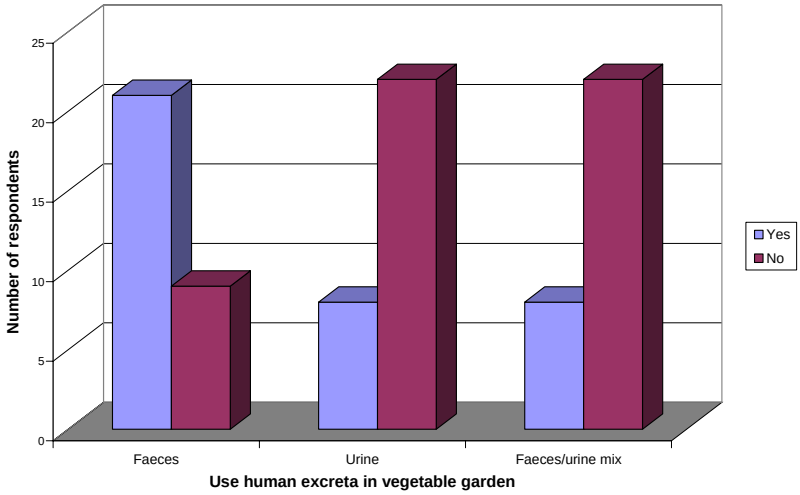


Figure 27: Use of human excreta in the Eastern Cape

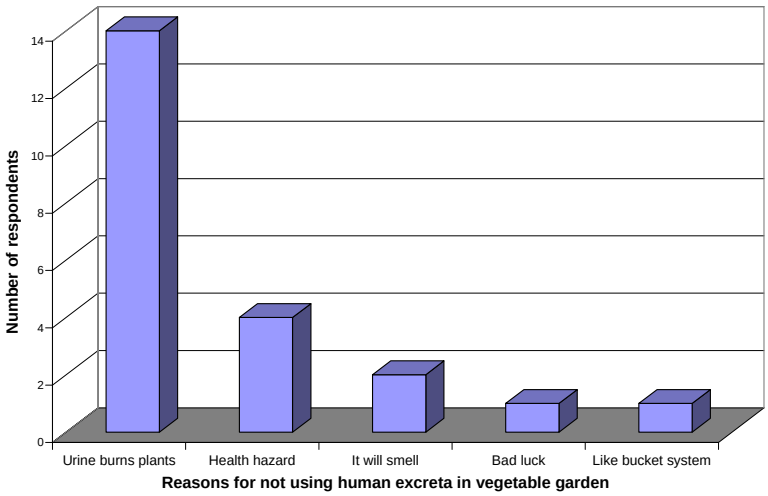


The respondents in Mthatha in the Eastern Cape were willing to use human excreta in their vegetable gardens as they had already been using urine diversion toilets for more than eight years and were aware of, and had experienced, the fertiliser value of human faeces in their gardens.

The respondents in Buffalo City were not using urine diversion toilets yet, even though they had been trained and prepared for the use of urine diversion sanitation; the implementation of the sanitation projects was about to start. However, the majority of these respondents replied that they would not be willing to use human excreta in their vegetable gardens.

The following reasons were provided by those who did not want to use human excreta in their vegetable gardens:

Figure 28: Reasons for not using human excreta in vegetable gardens in the Eastern Cape

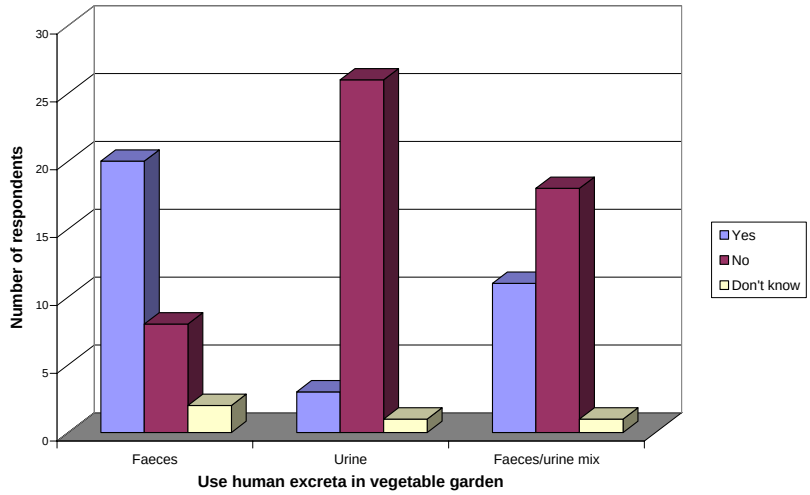


The main reasons were that the respondents thought that urine could burn and kill plants. Only four respondents replied that using human excreta was a health hazard.

The respondents in KwaZulu-Natal were not using urine diversion toilets, even though they were aware of urine diversion sanitation as they lived next to villages where urine diversion sanitation

projects had been implemented. The respondents replied that they would be willing to use human faeces in their vegetable gardens, but not human urine.

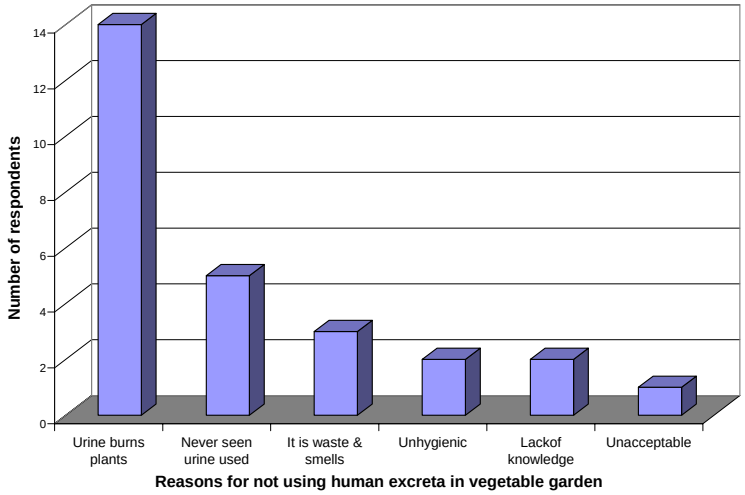
Figure 29: Use of human excreta in KwaZulu-Natal



The main reasons provided by those who did not want to use human excreta in their vegetable gardens were that they were unaware of the fertiliser value of human urine and that they thought it burned plants. A few respondents (3) mentioned that it was unhygienic and unacceptable to use human excreta in vegetable gardens.

The following reasons for not using human excreta in their vegetable gardens were also provided:

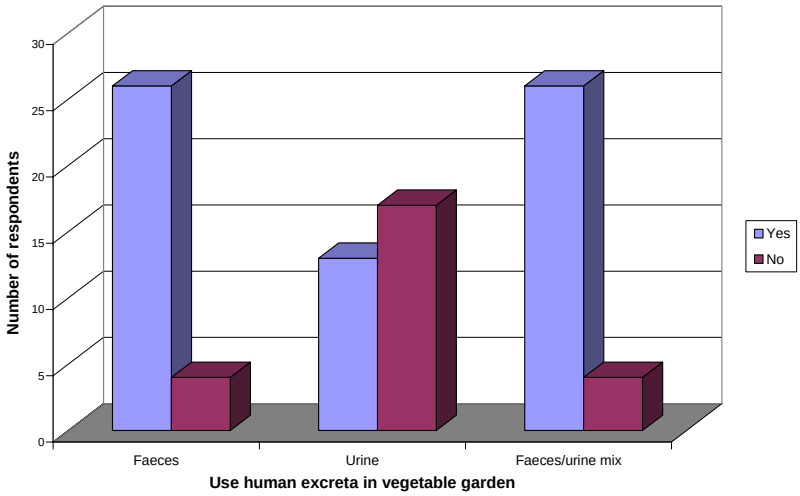
Figure 30: Reasons for not using human excreta in vegetable gardens in KwaZulu-Natal



The respondents in Limpopo Province had not previously been exposed to urine diversion sanitation and were using VIP or pit toilets. Of these respondents, 50% replied that they would be willing to use any form of human excreta in their vegetable gardens. This might be ascribed to their wish to have any kind of toilet that they perceived as better than the VIP and pit toilets they were using currently.

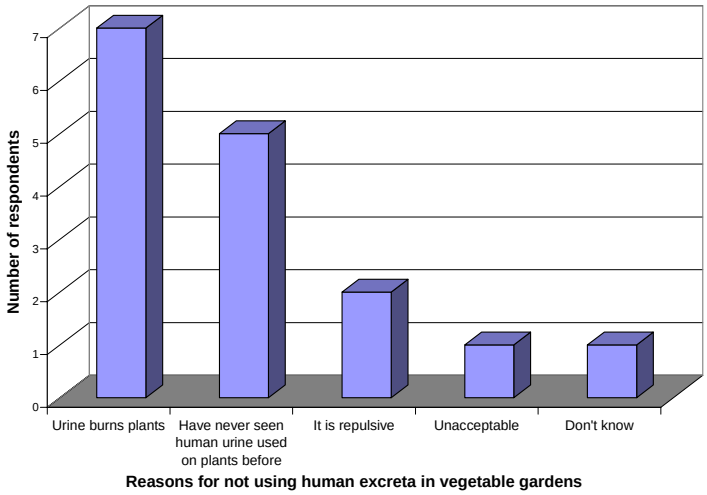
The main reasons provided for not using human excreta in their vegetable gardens were that human urine burned plants and that they were unaware of the fertiliser value of urine. A few respondents (3) mentioned that it was repulsive and unacceptable to use human excreta in vegetable gardens.

Figure 31: Use of human excreta in Limpopo Province



The following reasons were provided by those who did not want to use human excreta in their vegetable gardens:

Figure 32: Reasons for not using human excreta in vegetable gardens in Limpopo Province



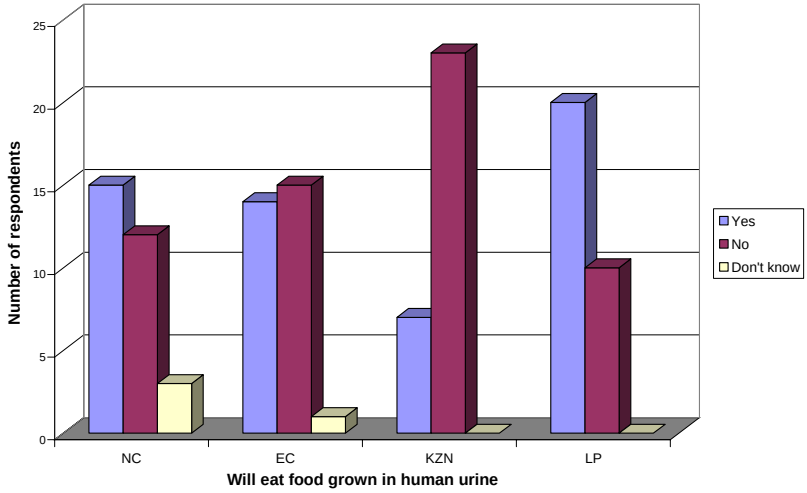
8.8.2 Consumption of food grown in human urine

Half the respondents in the Northern Cape and 46% of those in the Eastern Cape were willing to eat food that was grown in human urine. These respondents were already using urine diversion toilets and most were aware of the fertiliser value of human urine. Those who were not willing to eat food grown in human urine thought it was unhealthy (30%).

Most (76%) of the respondents in KwaZulu-Natal were not willing to eat food that was grown in human urine at all, because they were convinced that nothing would grow in human urine. Some (10%) said it was unhealthy and one respondent said it was culturally unacceptable.

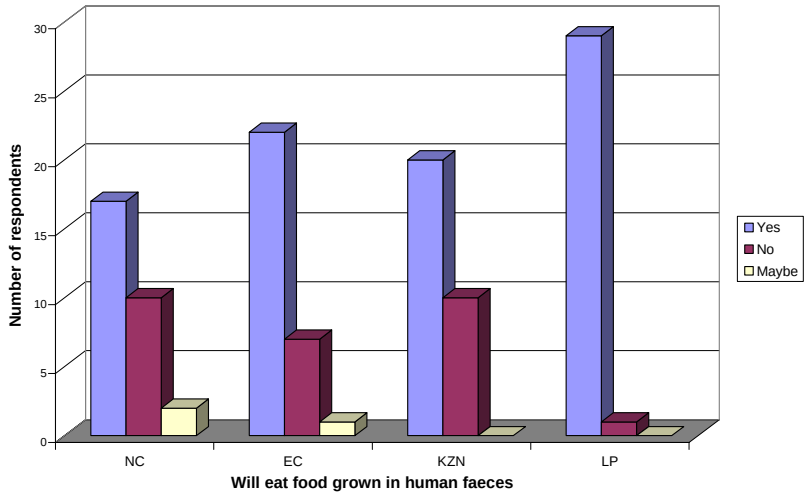
Two thirds of the respondents in Limpopo were willing to eat food that was grown in human urine. This could again be ascribed to the fact that they were not using urine diversion toilets and would want any toilet they perceived to be better than the VIP and pit toilets they currently had.

Figure 33: Food grown in human urine



8.8.3 Consumption of food grown in human faeces

Figure 34: Food grown in human faeces



In general, most (73%) of the respondents were willing to eat food that was grown in human faeces because the human faeces they were exposed to were dry, not offensive and looked like compost. The respondents also had been using animal manure as fertiliser in their gardens, which made the use of human faeces easier to accept. Almost all (96%) the respondents in Limpopo were willing to eat food that was grown in human faeces. Only one respondent found it a repulsive idea.

Those who were not willing to eat food grown in human faeces thought it was unhealthy or too bad to consider.

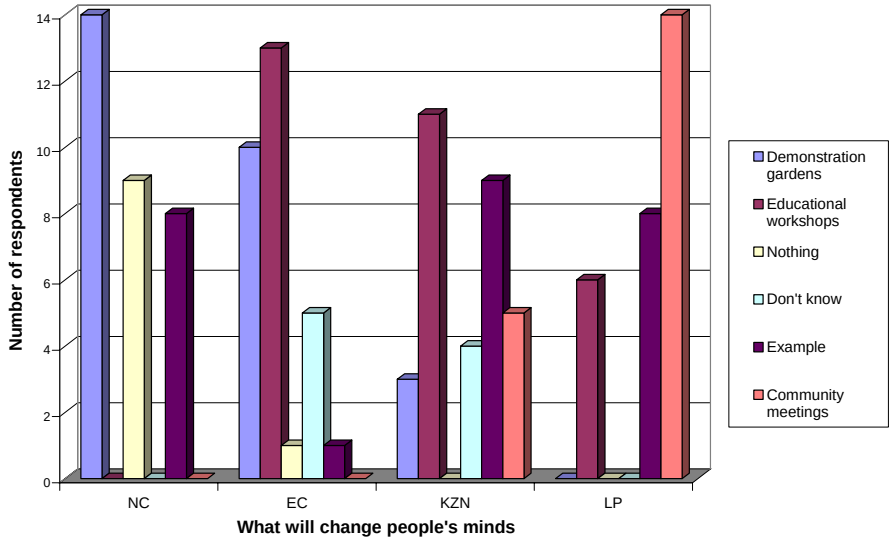
8.9 Change of attitude

The respondents were asked what they thought might work to change the minds of people towards using human excreta as fertiliser and soil conditioners in their gardens. The responses differed from province to province, according to the extent of exposure and experience of urine diversion sanitation.

Those respondents who were using urine diversion toilets thought that demonstration gardens, leading by example and educational workshops would be the best way to inform people and change their attitudes towards using human excreta for food production. However, the respondents in the Northern Cape said that, after using the urine diversion toilet for a long period, they had become disillusioned and disappointed in the system because it was badly constructed and became a cesspit, and that nothing at all would change the attitudes of the people towards urine diversion sanitation and using human excreta for food production.

The respondents who were not using urine diversion toilets in KwaZulu-Natal and Limpopo Province said that community meetings, leading by example and educational workshops might change people's attitudes towards using human excreta for food production.

Figure 35: Change of attitude



9. CONCLUSIONS

The literature review showed that the use of human urine and faeces for food production internationally, especially in China, is an old and well-known practice. In some countries in Africa the use of human urine and faeces is also accepted. However, in South Africa the handling of human excreta and its use for food production are still very foreign ideas and generally not acceptable. Human excreta are seen as waste products, unhealthy, unhygienic and detrimental to humans.

Human excreta, particularly urine, are excellent fertilisers and soil enhancers, and their efficacy has been proved in many countries under a variety of climatic conditions. Using urine is considered harmless and inoffensive, since urine is indistinguishable from water on the ground, and stepping into it is quite different from stepping onto human faeces. Positive attitudes towards the use of excreta need to

be reinforced with practical demonstrations on the safe use of human manure. Production of human manure should be associated with the safe use of animal manure. A fairly intensive use of excreta in agriculture would circulate most nutrients.

Urine diversion toilet users should be cautioned on the health hazards involved in handling untreated excreta for agricultural purposes. Good agricultural practices should also be encouraged, so as to ensure that faeces do not come into contact with the edible portions of crops. Excreta-related diseases are very common in developing countries, since excreta contain high concentrations of pathogens that can cause diseases in humans.

The data and results of the field research show that the level of education of the respondents in the rural areas did not have a direct effect on their perceptions and views of the use of human excreta for food production. It was clear that the level of information and knowledge regarding the use of human excreta for food production had a major impact on the views and perceptions of the respondents. The more the respondents knew about the fertiliser value of human excreta, the more willing they were to use it as fertiliser in their gardens.

The level of income of the households also did not have a major impact on the perceptions of the respondents regarding the use of human excreta. However, the households with higher income levels preferred flush toilets and were usually in the position to build their own, either with a soak pit or a septic tank.

In general the female respondents had a higher level of knowledge regarding the fertiliser value of human excreta and the medicinal value of human urine. However, the traditional gender roles in the communities were still observed and sanitation was regarded as a women's issue. Men, therefore, did not have much of an opinion regarding the use of human excreta. Most of the male respondents did reply that they would not be willing to eat food that was grown in human excreta because it was "unhealthy" and "unhygienic".

Exposure to urine diversion sanitation also had an influence on the perceptions and views of the respondents, as those who had the UD toilets also had to empty the vaults and decide what to do with the contents. In most cases the contents were either burned or disposed of elsewhere, and not used in vegetable gardens. The practice of emptying the vaults also had a negative influence on the perceptions and views of the users; the task was unpleasant and unhygienic, especially in the cases where the UD toilets had been badly constructed and the contents of the vaults were wet and smelly. The respondents who did not have UD toilets, and had not experienced the practice of maintaining the UD toilets and emptying the vaults, were more positive towards the UD toilet and the use of human excreta for food production. It is the opinion of the researchers that these interviewees responded positively in the hope of obtaining a UD toilet that would be, in their view, better than the VIP and pit toilets they currently had.

Cultural taboos were not mentioned as a major problem regarding the use of human excreta, except in the Eastern Cape. The health and hygiene issues were prominently mentioned mainly because of national and international hygiene campaigns (such as WASH) that had been run in most rural areas due to the outbreak of cholera. The messages of these hygiene campaigns were in opposition to the purpose and objectives of the 'closed-loop' ecological and urine diversion sanitation technology and strategies.

A major impact on the perceptions and views of the respondents, especially those in the Northern Cape, was the quality of construction of the UD toilets. It seems that there were no standard designs and norms according to which these toilets were supposed to be built. Many of the UD toilets had been

constructed by 'fly-by-night' contractors, using inferior and cheap materials in order to boost their profits. This had a major impact on the sustainability of these toilets.

In some cases the respondents had high expectations, as they had been promised by their premiers and councillors that waterborne sanitation would be installed. When the UD toilets were then built in their yards, they were already negative towards the technology and, in some cases, vandalised the toilets to prove that they were not appropriate to their situation and culture. Questioning these people regarding the use of human excreta from their toilets for food production was therefore a futile exercise.

Community participation in the implementation of urine diversion sanitation projects also had a major impact on the views and perceptions of the respondents. In KwaZulu-Natal the municipality decided to implement a dry sanitation strategy, but not to advocate the use of human excreta. The respondents felt that they had no input or choice in the matter, which also had a negative effect on acceptance of the technology. In the Northern Cape the respondents were acutely aware of the water scarcity in the area and understood the necessity for dry sanitation. The urine diversion sanitation projects had also been implemented with the participation and involvement of the households, and training in the operation and maintenance of the UD toilets was repeated. In the Eastern Cape Province the participation of the households in the implementation of, and training for, the urine diversion sanitation projects was regarded as very important. Therefore, the general acceptance of the UD technology, as well as the use of human excreta for food production, was higher than in the other provinces. Follow-up and support after implementation of the project, to iron out misunderstandings and problems, and retraining in operation and maintenance, were conducted to ensure the sustainability of the toilets.

Most of the respondents said that people would change their minds and use human excreta as fertiliser in their vegetable gardens if they were properly informed and workshopped on the advantages of doing so. Some also said that to lead by example was the best way; therefore councillors and highly respected people in the communities should start using human excreta in their gardens, and the rest would follow. Only a few respondents said that it would be totally impossible to change people's minds as it was culturally taboo to handle human excreta.

The general norm of not handling human excreta as it is considered unhygienic is still very strong among the respondents. Even though they said that they would use human excreta in their gardens and eat the food produced, it remains to be seen whether they will in actual fact do so.

10. RECOMMENDATIONS

It is of great significance to change societal or human perceptions in order to ensure the success of urine diversion sanitation technology. Part of the solution includes educating each other – involving all the stakeholders to participate in a project, coupled with institutional follow-up. Awareness programmes with practical demonstrations to show the beneficial aspects are essential to the take-up of ecosan activities. Government should play a major role in widely promoting the technology through various media. People promoting the technology should have extensive knowledge of the subject to ensure that users of this sanitation system understand it well, prior to implementing a project. Designing programmes that allow people to explore their realities more effectively (with participatory methodologies) combined with a social marketing approach that uses different mediums of communication (radio, drama, and visits to demonstration latrines) to reinforce knowledge would seem to enhance the programme considerably. Targeting middle- and high-income earners to promote the technology through the eco-village concept will also create some "status" for the technology. The reason for the latter is that the technology is currently viewed by most people in the communities as a poor man's technology, and therefore inferior

to other technologies. The health and hygiene education should emphasise safe use of human excreta on food production from the start to reinforce householders' choice of reuse of nutrients. The full concept of ecological sanitation and its potential benefits should be advocated rather than just the toilet function.

Achieving or marketing ecological sanitation solutions for food production requires a change in how people think about, and act towards, human excreta. Acceptability of this technology varies from one country to another. Some cultures do not accept the handling and direct use of human excreta. It is clear that cultural taboos in many parts of the world will have to be changed for people to accept using their faeces and urine as fertiliser for food crops. Therefore, adequate education and hygiene awareness campaigns in communities receiving ecosan toilets should be a prerequisite for the maintenance of public health. Demonstration toilets, peer education and peer pressure were reported to bring about attitude change in other countries. Demonstration creates awareness and visual aids improve and enhance understanding.

The fact that the use of human excreta for agricultural purposes is widely practiced (internationally and in Africa) shows that it is logical and acceptable from the users' point of view. If the excreted products could also be productively used, for example in agriculture, the technology will become even more attractive. In South Africa, where many communities rely on subsistence agriculture, often in poor soils, this is an important aspect (Austin & Duncker, 1999).

The researchers are of the opinion that this scoping study (along with other studies conducted by them) has distilled the major factors in determining the willingness of respondents to use human excreta for food production in communities in the rural areas, and that a larger and more in-depth study will yield the same information.

A study on the factors that are important in changing the perceptions and views of people regarding the use of human excreta for food production will be of great value, as the research has shown that scope does exist, and that people are willing to change their minds. Such a study should focus on the areas where urine diversion sanitation projects were successfully and sustainably implemented and where households are actively using human excreta in their vegetable gardens.

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www.objectivity.co.za

ANNEXURE A:

LOCATIONS OF RESEARCH AREAS

(marked with a red flower)

AREA	TOWN/ VILLAGE	DATES OF FIELD RESEARCH	INTERVIEW SCHEDULES COMPLETED	NUMBER OF INTERVIEWEES
Northern Cape	Augrabies	July 2006	30	34
Eastern Cape	Sinyondweni	July 2006	5	5
	Manyosini		5	5
	Gwebindkundla		5	5
	Scenery Park (East London)		15	5
KwaZulu-Natal	Kwa-Shozi	August 2006	30	30
Limpopo	Madombidza	August 2006	30	30

ANNEXURE B

INTERVIEW SCHEDULE FOR HOUSEHOLDS/INDIVIDUALS

For .....…….....

INTERVIEW SCHEDULE FOR HOUSEHOLD/INDIVIDUAL

Date:_____ Name of interviewer:_____

1. INTERVIEWEE:

1.1 Person(s) interviewed:

M		**F**	

1.2 Position in household:

Head of household	
Spouse	
Child	
Grandchild	
Grandparent	
Other (specify)	

1.3 Level of education:

No schooling	
Up to Gr 4	
Gr 5 to Gr 8	
Gr 9 to Gr 10	
Gr 11 to Gr 12	
University/Technikon/College	
Postgraduate qualification	

2. HOUSEHOLD INFORMATION

2.1 Number of people in household by age / gender:

0-3yrs.				**4-12 yrs.**				**13-21 yrs.**				**22-55 yrs.**				**56yrs.+**			
M		**F**		**M**		**F**		**M**		**F**		**M**		**F**		**M**		**F**	

For .....…….....

2.2 Average income per month of household:

Up to R200	
R201 to R500	
R501 to R800	
R801 to R1 000	
R1 001 to R3 000	
More than R3 000	

2.3 Source of income:

Monthly salary	
Seasonal work Period:	
Self-employed	
Pensioner	
Social grant	
Children send money	
Other (specify)	

3. NUTRITION

3.1 Gardens:

Vegetable garden	
Flower garden	
Fruit trees	
Maize/corn fields	
Other (specify)	

3.2 Location of gardens:

In the yard	
In communal area	
Outside borders of settlement	
Other (specify)	

For .....…….....

3.3 Main source of water for the garden:

Well	
Borehole	
Yard tap	
Street tap	
River/stream	
Other (specify)	

3.4 Main purpose of the vegetable garden:

Household use	
Selling produce	
Other (specify)	

3.5 Main purpose of the maize/corn fields:

Household use	
Selling produce	
Other (specify)	

3.6 How much is earned per month by selling produce:

Up to R20	
R21 to R50	
R51 to R80	
R81 to R100	
R101 to R300	
More than R300	

For .....……..…..

3.7 Who is responsible for the following:

Activity	**Male**	**Female**
Preparing the garden area		
Preparing the maize/corn fields		
Planting		
Tending		
Watering		
Harvesting		
Using produce		
Selling produce		

3.8 Use of fertiliser:

Garden	**Yes**	**No**
Flower garden		
Vegetable garden		
Maize fields		
Other (specify)		

3.9 Type of fertiliser:

Garden	**Compost**	**Chemical**	**Organic (manure)**	**Human excreta**
Flower garden				
Vegetable garden				
Maize fields				
Other (specify)				

3.10 If using compost, what is it made up of: ……..

……..

……..

……..

……..

For .....……..…..

3.11 If using human excreta as fertiliser:

Garden	**Urine only**	**Faeces only**	**Urine mix**	**Faeces mix**
Flower garden				
Vegetable garden				
Maize fields				
Other (specify)				

3.12 How much is spent on buying fertiliser per month:

Up to R20	
R21 to R50	
R51 to R80	
R81 to R100	
R101 to R300	
More than R300	

3.13 Reasons for not having a garden: ……..……..……

…….

……..…….

…….

3.14 How much is spent on buying produce per month:

Up to R20	
R21 to R50	
R51 to R80	
R81 to R100	
R101 to R300	
More than R300	

For .....……..…..

4. SANITATION

4.1 Type of toilet:

Pit toilet	
VIP toilet	
UDS	
Composting toilet	
Flush toilet	
Other (specify)	

4.2 Who decided on this type of toilet?

Household members	
Sanitation committee	
Councillors	
Municipality	
Funding agency	
Other (specify)	

4.3 Did the household have a choice of sanitation system?

Yes	No

4.4 How long have the household been using the toilet?

1 – 6 months	
7 – 12 months	
1 – 2 years	
2 – 3 years	
Longer than 3 years	

4.5 How many people use the toilet per day? ……..

4.6 Do men and women use the same toilet?

Yes	No

For .....……..…..

4.7 Do they like the toilet they have?

Yes	No

4.8 If yes, what do they like about the toilet? …..……

…….

…….

……..

4.9 If no, what do they not like about the toilet? ……..

…….

…….

……..

4.10 Do they prefer the toilet above other toilets (apart from flush toilets)?

Yes	No

4.11 Why? …….

...…….

...……

5. RE-USE (in case of UD toilet)

5.1 Disposal of urine:

Soak pit	
Piped to fruit trees	
Piped to flower garden	
Collected in container	
Other (specify)	

5.2 Does the household have objections to emptying the vault and disposing of the contents themselves?

Yes	No

For .....……..…..

5.3 If yes, what are the objections? ……..

…….…….

….…….

….…….

5.4 Was it necessary to empty the vault since they started using the toilet?

Yes	No

5.5 What does/will the household do when the vault is full?

Bury it	
Burn it	
Throw it in a rubbish pit	
Throw it away in the veld	
Use it in the flower garden	
Use it in the vegetable garden	
Other (specify)	

5.6 Is the household prepared to pay for a collection service for human excreta?

Yes	No

5.7 If yes, how much are they willing to pay per month?

Up to R5	
R6 to R10	
R11 to R20	
R21 to R30	
R31 to R50	
More than R50	

For .....……..…….....

6. PERCEPTIONS RE HUMAN EXCRETA

6.1 What cultural meanings are attached to human urine (taboos, religion, witchcraft, medicine, initiation, disease, etc.)? ……..……

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6.2 What cultural meanings are attached to human faeces (taboos, religion, witchcraft, medicine, initiation, disease, etc.)? ……..……

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6.3 What is the difference between human faeces and animal faeces? ……

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6.4 What perceptions do **men** have about:

Human urine	Human faeces

For .....…….....

6.5 What perceptions do **women** have about:

Human urine	Human faeces

6.6 What do human excreta do to plants:

Human urine	Human faeces

6.7 What does the household use human excreta for:

Human urine	Human faeces

6.8 Are the household members aware of the fertilizer value of faeces and urine?

	Yes	**No**
Faeces		
Urine		

For .....……..…..

6.9 Do/will the household members use the faces and/or urine in their vegetable gardens?

	Yes	**No**
Faeces		
Urine		
Faeces and urine		

6.10 If no, why not? ……

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6.11 What kind of food can be grown using fertiliser from human faeces?

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6.12 What kind of food can be grown using fertiliser from human urine?

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6.13 Will the household members eat food that has been grown using human urine as fertilizer?

Yes	No

6.14 If no, why not?

……

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……

For .....……..…..

6.15 Will the household members eat food that has been grown using human faeces as fertiliser?

Yes	No

6.16 If no, why not?

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……...……

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6.17 What will change people's minds to start using human urine for growing food?

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…….……..

……

6.18 What will change people's minds to start using human faeces for growing food?

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……...……

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……

Thank the respondents sincerely for his/her/their contribution and cooperation.

ANNEXURE C

INTERVIEW SCHEDULE FOR HOUSEHOLDS/INDIVIDUALS LIMPOPO

For .....…….....

INTERVIEW SCHEDULE FOR HOUSEHOLD/INDIVIDUAL LIMPOPO

Date:_____ Name of interviewer:_____

1. INTERVIEWEE:

1.1 Person(s) interviewed:

M		**F**	

1.2 Position in household:

Head of household	
Spouse	
Child	
Grandchild	
Grandparent	
Other (specify)	

1.3 Level of education:

No schooling	
Up to Gr 4	
Gr 5 to Gr 8	
Gr 9 to Gr 10	
Gr 11 to Gr 12	
University/Technikon/College	
Postgraduate qualification	

2. HOUSEHOLD INFORMATION

2.1 Number of people in household by age / gender:

0-3yrs.				**4-12 yrs.**				**13-21 yrs.**				**22-55 yrs.**				**56yrs.+**			
M		**F**		**M**		**F**		**M**		**F**		**M**		**F**		**M**		**F**	

For .....…….....

2.2 Average income per month of household:

Up to R200	
R201 to R500	
R501 to R800	
R801 to R1 000	
R1 001 to R3 000	
More than R3 000	

2.3 Source of income:

Monthly salary	
Seasonal work Period:	
Self-employed	
Pensioner	
Social grant	
Children send money	
Other (specify)	

3. NUTRITION

3.1 Gardens:

Vegetable garden	
Flower garden	
Fruit trees	
Maize/corn fields	
Other (specify)	

3.2 Location of gardens:

In the yard	
In communal area	
Outside borders of settlement	
Other (specify)	

For .....…….....

3.3 Main source of water for the garden:

Well	
Borehole	
Yard tap	
Street tap	
River/stream	
Other (specify)	

3.4 Main purpose of the vegetable garden:

Household use	
Selling produce	
Other (specify)	

3.5 Main purpose of the maize/corn fields:

Household use	
Selling produce	
Other (specify)	

3.6 How much is earned per month by selling produce:

Up to R20	
R21 to R50	
R51 to R80	
R81 to R100	
R101 to R300	
More than R300	

For .....……..…..

3.7 Who is responsible for the following:

Activity	**Male**	**Female**
Preparing the garden area		
Preparing the maize/corn fields		
Planting		
Tending		
Watering		
Harvesting		
Using produce		
Selling produce		

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Garden	**Yes**	**No**
Flower garden		
Vegetable garden		
Maize fields		
Other (specify)		

3.9 Type of fertiliser:

Garden	**Compost**	**Chemical**	**Organic (manure)**	**Human excreta**
Flower garden				
Vegetable garden				
Maize fields				
Other (specify)				

3.10 If using compost, what is it made up of: ……..

……..

……..

……..

……..

For .....……..…..

3.11 If using human excreta as fertiliser:

Garden	**Urine only**	**Faeces only**	**Urine mix**	**Faeces mix**
Flower garden				
Vegetable garden				
Maize fields				
Other (specify)				

3.12 How much is spent on buying fertiliser per month:

Up to R20	
R21 to R50	
R51 to R80	
R81 to R100	
R101 to R300	
More than R300	

3.13 Reasons for not having a garden: ……..……..……

…….

……..…….

…….

3.14 How much is spent on buying produce per month:

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R21 to R50	
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For .....……..…..

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Councillors	
Municipality	
Funding agency	
Other (specify)	

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Yes	No

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7 – 12 months	
1 – 2 years	
2 – 3 years	
Longer than 3 years	

4.5 How many people use the toilet per day? ……..

4.6 Do men and women use the same toilet?

Yes	No

4.7 Do they like the toilet they have?

Yes	No

For .....……..

4.8 If yes, what do they like about the toilet? …..……

……

……

……..

4.9 If no, what do they not like about the toilet? ……..

……

……

……..

4.10 Do they prefer the toilet above other toilets (apart from flush toilets)?

Yes	No

4.11 Why? …….

..…….

...……

4.12 Does the household know about UDS?

Yes	No

4.13 If yes, what do they know? ……..…….

…....…….

…....……

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…....……

…....……

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…....……

…....……

For .....……..…..

5. RE-USE OF NUTRIENTS

5.1 Would the household have objections to emptying a vault and disposing of the contents themselves?

Yes	No

5.2 If yes, what are the objections? ……..

……..…….

….…….

….…….

5.3 Might the household be prepared to pay for a collection service for human excreta?

Yes	No

5.4 If yes, how much are they willing to pay per month?

Up to R5	
R6 to R10	
R11 to R20	
R21 to R30	
R31 to R50	
More than R50	

6. PERCEPTIONS RE HUMAN EXCRETA

6.1 What cultural meanings are attached to human urine (taboos, religion, witchcraft, medicine, initiation, disease, etc)"?

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For .....……..…..

6.2 What cultural meanings are attached to human faeces (taboos, religion, witchcraft, medicine, initiation, disease, etc)"? ……...……

…….....……

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6.3 What is the difference between human faeces and animal faeces? ……

……..

……..

……..

6.4 What perceptions do **men** have about:

Human urine	Human faeces

6.5 What perceptions do **women** have about:

Human urine	Human faeces

For .....…….....

6.6 What do human excreta do to plants:

Human urine	Human faeces

6.7 What does the household use human excreta for:

Human urine	Human faeces

6.8 Are the household members aware of the fertilizer value of faeces and urine?

	Yes	**No**
Faeces		
Urine		

6.9 Do/will the household members use the faces and/or urine in their vegetable gardens?

	Yes	**No**
Faeces		
Urine		
Faeces and urine		

For .....……......

6.10 If no, why not? ……

……...……

……..……..

……

6.11 What kind of food can be grown using fertiliser from human faeces?

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……...……

……..……..

……

6.12 What kind of food can be grown using fertiliser from human urine?

..…….…….

……...……

……..……..

……

6.13 Will the household members eat food that has been grown using human urine as fertilizer?

Yes	No

6.14 If no, why not?

……

……...……

……..……..

……

6.15 Will the household members eat food that has been grown using human faeces as fertiliser?

Yes	No

For .....……..…..

6.16 If no, why not?

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……...……

…….……..

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6.17 What will change people's minds to start using human urine for growing food?

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6.18 What will change people's minds to start using human faeces for growing food?

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Thank the respondents sincerely for his/her/their contribution and cooperation.