Water: A South African Perspective©

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INTRODUCTION

South Africa (SA) is a very diverse country. This is true for both its population and geographic environment. As a new democracy, it faces a wide range of challenges. With this in mind, it is understandable that water and water management must be seen in a holistic view. To get a true picture of water in South Africa, it is important to understand the socio-economic situation when considering the challenges that face this new democracy.

SOCIO-ECONOMIC SITUATION

The lack of development in South Africa had been a serious impediment to its socio-economic situation. Thus, challenges on this front had an impact on water and water management. At present the South African government finds itself having to balance the needs of its people and the need for sustainable usage and development. South Africa has a population of approximately 46 million, which consists of: 37 million African/black; 4 million white; 4 million coloured; and 1 million Asian/Indian. The average unemployment rate is 40% (Lehola, 2004).

Currently the minimum monthly wage in the agricultural sector is set at about R 900. Household income varies between different population groups. The latest statistics show that the monthly household income of white families varies between R7,500 to R11,000 compared to that of black families, which is approximately R2,200. The difference in income can be attributed to different education and training levels between these population groups (Lehola, 2004).

AIDS poses a serious problem. Currently almost 10% (5.3 million) of South Africa's population is infected with the virus. The supply of free antiviral treatment to these people impacts severely on the national budget. Previously disadvantaged groups also lacked basic services including houses, running water, and electricity. Over the past 10 years 1 million taps with running water have been installed. There is still a big backlog in the supply of basic services (Anon, 2004a).

Illegal immigrants have a negative influence on the economy. It is difficult to predict the number of illegal immigrants, but this might run into millions. It is important that Africa or at least the sub-continent develops as a whole. Any geographically distorted development will lead to an even bigger influx of illegal immigrants.

South Africa has one of the most diverse fauna and flora in the world, and this diversity is also true for its human population. A simple example of this is that there are 11 official languages. Cultural differences and African traditions have an impact on the diffusion of new innovations. Thus, the education of these culturally diverse groups poses a big challenge.

GOVERNMENTAL PRIORITY

Currently the South African government is focusing on the following socio-economic areas:

- Job creation and the alleviation of poverty.
- Education.
- The treatment and prevention of AIDS and other related diseases.
- Economy restructuring. This includes small business development, export development, and economic empowerment of previously disadvantaged groups.
- Basic service delivery including housing, running water, and electricity.

In the short term the above-mentioned areas will need significant resources. Therefore, water management may not be as high on the list of priorities as it perhaps should be. Despite these challenges facing South Africa, water is still an important natural resource and therefore water management is important. The improvement of living conditions of South African people will have an indirect positive effect on water and water management (Anon, 2004a).

The next part of this paper will give an overview of the South African climate, water usage, management of water, and problems related to it in the horticultural sector as a subsection of Agriculture.

CLIMATE

South Africa receives an annual rainfall of 492 mm, which means that South Africa can be classified as a semi-arid country. There is also an uneven distribution of rainfall across South Africa. The west of the country receives much lower amounts of rainfall than the east. South Africa also faces sporadic periods of flood and drought. During the 2003 season South Africa experienced its worst drought in 75 years. Drought relief to farmers for this season amounted to R1000 million. Extremes in minimum and maximum temperatures have become a common occurrence. With increases in temperature the demand for water also increases, which further compounds the problems of the rainfall shortage. Currently groundwater reserves are at an alarming low level. Water storage in dams will be insufficient as our population increases and the demand for water becomes greater. The challenge facing agriculture is to use less water more efficiently (Anon, 2004b).

THE INFLUENCE OF INVASIVE PLANTS

Many exotic plants that were introduced in good faith during previous centuries have become invasive. Statistics show that more than 20% of the area of the world famous Cape Flora Kingdom (90,000 km^2 with 8,500 endemic species) is densely covered by invaders from 72 taxa. These invasive plants not only threaten the survival of many native plant species, but also have a detrimental effect on our natural water resources. Water used by invading aliens results in an estimated 6.67% reduction in the mean annual run-off for the entire country. The most important invaders are the Australian *Acacia* sp., which have invaded 4.6 million hectares. *Eucalyptus* covers a combined area of 63,000 ha (Versveld et al., 1998).

To tackle this problem the "Working for Water" concept was launched. The core business of the programme is the control of invasive alien plants. The South African government saw the potential of job creation within this concept and thus "Working

for Water" was launched in 1995 with an allocation of R25 million from the Reconstruction and Development Programme. Since then the programme has cleared alien invaders from a million hectares of land, created employment for 20,000 workers, and has an annual budget of over R400 million. Of this budget, R23 million has been allocated for research purposes. The "Working for Water" programme is a good example of tackling socio-economic and environmental problems in one (Versveld et al., 1998).

POLLUTION OF RIVERS AND DAMS

During the last decade pollution of rivers and dams has became a serious problem. This is especially true for rivers and dams that are situated in or near densely populated areas. The building of informal settlements next to rivers has disastrous consequences. These settlements have no basic amenities and the residents use water from the river for cooking and washing. This uncontrolled pollution of water leads to the spread of serious diseases like cholera. The problem of informal settlements is a socio-economic one and will only be solved if basic services are delivered to each and every person (Anon, 2004a).

Run-off water from agriculture and industries also pollutes rivers and dams. The National Water Act of 1998 includes strict regulation on the quality of water that may be released by industries into the rivers. Although most industries adhere to these regulations, rivers and dams are still being polluted. Phosphate has been identified as the greatest pollutant. Since the 1970s the South African government spent in excess of R800 million in the development and implementation of the phosphate standard, but at present this is not achieving its goals. A good example of this is the Hartebeespoort Dam just outside the Capital city of Pretoria. The dam covers an area in excess of 1000 ha. At present cyanobacterial scum flourishes on the phosphate levels of 0.12 $mg \cdot L^{-1}$. The physical removal of the scum, at R1 million per ton is not a viable long-term solution. To solve the problem of this and 12 other dams, a biological water management system will be introduced. In practical terms this will mean the adjustment of the biodiversity in the water body. The occurrence of zooplankton, specifically the *Daphia* water flea that feeds on algae, must be increased. Bottom feeders that stir-up nutrient rich sediment must be decreased. The treatment of water as it comes into dams is also proposed. This combined approach should reduce phosphate levels by up to 80% in our dams (Anon, 2004a).

WATER AND WATER MANAGEMENT IN THE HORTICULTURE INDUSTRY

1) Water-usage. Currently, water use in South Africa is estimated at 16 billion cubic meters per annum. This usage is divided as follow: agriculture 52%, nature conservation 20%, domestic use 12%, industry 8%, mining 4%, power generation 4%.

2) Sources of Water Available for Irrigation.

- Water that is supplied from the local city council. This water is only available within city council boundaries. It is of good quality but expensive (R ±5 per m^3). This water is not commonly used for nursery production.
- Water from irrigation schemes and rivers. This water is of relative good quality and is inexpensive R 0.24 per m^3. Where available this source is used.

- Ground water supplied through bore holes. This is the most commonly used source of water in horticulture. Water quality in terms of chemical composition may be a serious problem in this source of water.

3) Water Management. A general overview of water management in the ornamental industry will be given. In terms of water management, the ornamental industry will be divided into: floriculture and pot plant nurseries; landscaping and gardening industry; and ornamental nurseries.

Floriculture and Pot Plant Nurseries. This sector is set to grow at a rate of approximately 24% per annum. In 1995 South African flower export totaled US $10 million. In 1998 South Africa had 0.4% of the world flower export market, with a value of US $30 million. At that stage the production area consisted of 350 ha indoor production, 700 ha open field production, and the intensive and extensive production of protea on 4500 ha. Most of this produce is exported to Europe. New markets are being developed in Japan, the Middle East, and America. The floriculture industry was identified as an industry with huge potential for job creation. A plan has been put into action that would see this industry grow to the point where South Africa captures 3% to 4 % of the world flower export market (US $280 million) within 10 years. This growth would result in the creation of 800,000 new jobs (De Bruin and Boshoff, 2000). Preliminary statistics show that this plan is on track.

The main reasons for the strong growth in this sector can be summarized as follows:

- Lifting of economic sanctions in the early 1990s opened up new markets.
- Low production costs (labor, land, water, and electricity) improve South Africa's competitiveness.
- A first world infrastructure supports the industry.
- A relative weak South African rand against the U.S.A. dollar makes it a competitive and profitable industry.
- The fact that South Africa is in the same time zone as Europe, gives us the opportunity to put flowers on the European market within 15 h.
- South Africa has unique products for the world market.
- Governmental support and financing.
- Opening of new markets including Japan, America, and the Middle East.

Because this industry is quality driven its management of water is optimal. First world technology is used in water management.

Water Recycling. A relatively new concept for South African nurseries is water recycling. The implementation of recycling varies between different nurseries. Most new flower nurseries are planned and built in such a way as to optimize water recycling and the catchment of runoff water from roofs and paved areas.

Water Storage. Most new dams are sealed with PVC liners. Nurseries try to store their water requirements for at least 12 months.

Water Filtration. The use of sand and disc filtration systems is common in most flower nurseries. The newest technology used is ultra filtration. These filters help in the reduction of *Phytophthora* and other soil-borne pathogens.

Chemical Disinfection. Chlorination and the use of UV radiation are most commonly used, however, acid treatment of irrigation water is also practiced. Sulfuric and nitric acid are used to adjust the pH of irrigation water to the desired levels.

Irrigation and Fertigation. As significant areas of production use open hydroponic systems, irrigation scheduling and fertigation are computer controlled.

Open-Field Production. Water management in open-field production is much less intensive. Most nurseries would use a drip irrigation system and thus disc filtration. Dense growing crops such as *Ruscus* and leather leaf are produced under inexpensive sprinkler irrigation systems. Ordinary fertigation would be by means of a dozatron. Mulches are used to conserve water, reduce soil temperature and reduce the occurrence of weeds.

Open Hydroponics. The open-field production of crops in an open hydroponic system is increasing strongly. The supply of water and fertilizers are correlated to the phenological chart of the crop. The system is computer controlled and supplies considerable feedback on a number of parameters. The nursery owner is able to grow his crop under optimal conditions. These systems are specifically used for tree crops.

Landscape and Gardening Industry. The landscape and gardening industries are under pressure to promote the concept of water conservation. Rand Water introduced the promotion to the public of the concept of water wise gardening. Water-wise gardening encourages the responsible use of water in gardens and landscapes (Anon, 2003). In short water-wise gardening promotes the use of soil additives to increase water holding-capacity of soils, the use of indigenous plants that are better adapted to local weather conditions, mulching to conserve water, the use of grey water as an alternative water source, and the use of drip irrigation where possible.

Ornamental Nurseries. The ornamental nursery industry is cost-driven. Production of plants is mainly for the landscape and retail markets. An overall growth in the economy over the last 10 years resulted in a good growth in this industry. The development of neighboring countries has opened an export market for this industry. Cheap labor costs have meant that this industry does not implement first world technology. The South African government advocates technology that is appropriate and leads to job creation and this is, therefore, what is implemented by the ornamental nursery industry. Accordingly, this industry does not always produce plants of the best quality.

Water Management. The fact that this industry is cost driven and uses appropriate technology implies that it is lacking in some areas of water management. There are nurseries that have good water management systems but the majority are not up to standard. Most nurseries use underground water resources and there is minimal water recycling. Very few nurseries recycle water. Poor quality water is seldom treated. Common water quality problems relate to pH and alkalinity, which lead to poor root and plant growth.

Plants are typically produced in plastic bags on plastic sheeting under inexpensive sprinkler irrigation systems. Soil splash from poorly drained areas in the nursery is a common conduit for the spread of pathogens. Irrigation scheduling receives little attention. Many nursery owners would do their irrigation scheduling out of personal experience under prevailing weather conditions. Plant type, stage of

growth, and potting soil properties are rarely taken into account. The thinking is, better to over-irrigate than under-irrigate. This over irrigation results in over use of water, leaching of nutrients, and poor quality plants.

Reasons for Poor Water Management. The reasons for poor water management in a large number of ornamental nurseries can be summarized as follows:

- It is cost driven.
- The buyer/consumer is satisfied with a lower quality product at a lower price.
- Little legislation exists for nurseries and existing legislation is not taken seriously.
- Lack of training of nursery owners.
- Sophisticated production methods (appropriate technology) are not yet applied.

CONCLUSION

South Africa faces many challenges. Within these challenges water is still important. Within the horticulture sector some industries lack good water management practices. The solution lies in understanding and training. The South African Potential Region of the IPPS has committed itself to improve the level of training of every person in the nursery industry. By becoming an accredited training organization for the horticulture industry in South Africa we will do our best for this industry. We ask every member of the I.P.P.S. to assist us in this venture.

LITERATURE CITED

Anon. 2003. Information bulletin. Gardenex show. Rand Water. Johannesburg. South Africa.

Anon. 2004a. The water wheel: Incorporating the Water Research Commission's SA Waterbulletin. February issue, Vol. 3 No. 1.

Anon. 2004b. 'Droogtehulp'. 'Beeld' local newspaper. Monday, 26 Jan. 2004. <www.beeld.com>, South Africa.

De Bruin, D. and **H. Boshoff.** 2000. An export strategy for the strategy for the South African floricultural industry: Summary report of the NEDLAC/FRIDGE cluster study. South African Export Council (SAFEC), Johannesburg, South Africa.

Lehohla, P. 2004. Statistics South Africa 2004. Bulletin of Statistics, March 2004, Vol. 38 No. 1.

Versveld, D.B., D.C. Le Maitre, and **R.A. Chapman.** 1998. Alien invading plants and water resources: A preliminary assessment. Water Research Commission, P.O. Box 824, Pretoria, 0001, South Africa.