Wonder crop could pave the way for bio-fuel revolution

"The price of petrol and diesel is going up!" This has become a familiar announcement on the evening news. High oil prices due to increased demand, tougher environmental requirements, uncertainties linked to terrorism and instability in the Middle East are some of the pressures that are influencing the quest for alternative, cleaner forms of energy. Some would say that the bio-fuel revolution has begun. Farming for energy is one avenue that is being actively explored. While offering a potential solution to the agricultural sector's quest for rural employment and poverty alleviation, it also offers to fulfil the need for increased use of renewable energy resources.

In response to these trends, recent business initiatives have proposed the introduction of so-called "wonder-crop" exotic species for large-scale planting and bio-diesel production in South Africa. The motives behind these initiatives have been the laudable themes of ecological sustainability, poverty alleviation, job creation and business development. However, questions around the potential hydrological, ecological and socio-economic effects of the associated land use changes remain unanswered due to a lack of information.

The Land Use Hydrology group of the CSIR in Pietermaritzburg forms part of a team tasked by the Water Research Commission to conduct a study into some of the impacts associated with the large-scale planting of *Jatropha curcas*. The CSIR's task is to conduct hydrological process studies of Jatropha water use at selected sites in KwaZulu-Natal, using appropriate techniques (site water balance and evapotranspiration measurements). This is to be followed by a modelling exercise wherein site-specific simulations of water use will be verified against the measured data and extrapolated to a larger scale.

Mark Gush, research scientist working on this project, explains that *Jatropha curcas* was identified as an ideal species to use for this study because it has been widely accepted to be suitable for the production of bio-diesel and secondary products. The prime ingredient in the manufacture of bio-diesel is vegetable oil (e.g. sunflower, soya or peanut oil), however, these oils are edible and generally fetch high prices, which preclude them from being used in bio-diesel production. Research indicated that *Jatropha curcas* merited serious consideration as a viable alternative.

This small tree (of Central American origin) is from the *Euphorbiaceae* family, and produces seeds containing high percentages (30-35%) of oil, which can easily be extracted for further processing (trans-esterification into bio-diesel) and refinement. The processed oil can then be used in compression-ignition (diesel) engines after minor modifications. It can also be blended with conventional diesel to avoid the need for engine modification. The by-products of the bio-diesel processing plant are the nitrogen-rich press cake and glycerol, which have good commercial value as fertiliser and as a base for soap and cosmetics respectively. The leaves, roots and bark could also potentially be used for numerous other industrial and pharmaceutical uses.

Jatropha curcas grows readily in areas of low rainfall (>250 mm per year) and in poor soils, allowing the potential use of low fertility, marginal, degraded and otherwise unproductive lands. The trees are easy to establish (from seeds or cuttings), grow

relatively quickly (producing seed after their second year) and are hardy to drought, although they are relatively sensitive to frost.

“The interest in this species has heightened to a stage where the relevant national government departments (Agriculture, Water Affairs and Forestry, Environmental Affairs etc.) need to make a decision as to whether or not to allow the large-scale propagation and commercialisation of this crop,” says Gush. “This project aims to contribute to the Strategic Environmental Assessment (SEA) proposed by the Department of Agriculture to investigate the feasibility, viability and advisability of the wide-scale introduction of *Jatropha curcas* to the KwaZulu-Natal province and South Africa as a whole.”

Enquiries:

Mark Gush
Research Scientist
CSIR Water, Environment and Forestry Technology
Tel: +27 33 260 5783
Fax: +27 33 260 5266
Email: mgush@csir.co.za

Figure 1. The seed pods and kernels of *Jatropha curcas* (photo - Mark Gush).

Figure 2. **Photo showing the leaves and fruit (with seed kernels exposed) of *Jatropha curcas* (photo - Reinhard Henning).**

Figure 3. **Example of a 30-month-old *J. curcas* tree, at Owen Sithole College of Agriculture near Empangeni (photo - Mark Gush).**

Figure 4. **A fence-line of 10-year-old *J. curcas* trees at a rural homestead on the Makhathini flats near Jozini (photo - Mark Gush).**

Figure 5. **A plantation of 30-month-old *J. curcas* trees at the Makhathini Research Station near Jozini (photo - Mark Gush).**