Climate change

Climate change will affect profitability of SA farms differently, says SU researcher

Climate change will affect the profit margins of farms throughout South Africa differently. Much depends on how rainfall, temperature and the subsequent need for irrigation change the yield and quality of the produce being farmed with in specific regions. So says agricultural economist Dr Hamman Oosthuizen, who used farms in Hoedspruit, Carolina, Moorreesburg and Vredendal as case studies for his doctoral research at Stellenbosch University. The study combines efforts of researchers from three South African universities.

Article by Engela Duvenage.

Dr Oosthuizen's research formed part of a Water Research Commission (WRC) project on "Adaptive interventions in agriculture to reduce vulnerability of different farming systems to climate change in South Africa' (WRC project number K5/1882//4). The research is co-funded by the Department of Agriculture, Forestry and Fisheries and investigates the impact of how climate change will impact agriculture, and assesses the vulnerability of crops, rangelands, farming households and enterprises. It also endeavours to identify and suggest appropriate adaptive techniques and practices to use in selected catchments and farming areas.

Dr Oosthuizen teamed up with climatologists and hydrologists from two South African universities to develop relevant data driven models on which to base his projections. His modelling study is one of the end results of a much broader initiative involving data and models from the Climate Systems Analysis Group (CSAG) from University of Cape Town (UCT) and the Centre for Water Resources Research at the University of KwaZulu-Natal (UKZN).

"It is a given that the agricultural sector is vulnerable to climate change, both physically and economically, as concluded by various studies, local and abroad," explains Dr Oosthuizen.

Dr Hamman Oosthuizen was one of the researchers on a WRC project aimed at understanding how climate change will impact agriculture.

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"The impact of such financial vulnerability goes beyond the farm gate, because many livelihoods in rural areas are dependent on the agricultural industry, by one way or the other," adds Dr Oosthuizen, whose findings have already been presented at international conferences in China, Mexico and Belgium. A paper detailing the Hoedspruit case study was published in the International Water Association's Water, Energy and Climate (WEC) conference proceedings.

Dr Oosthuizen believes the new integrated Crop Critical Climate Threshold (CCCT) modelling technique he developed can be applied to any agricultural production region in South Africa or elsewhere in Africa for which climate and hydrological models and accurate input data are available. It combines climatic, hydrological and economic models into an integrated climate change model that determines how climate change will influence the financial vulnerability of farming systems at farm level.

The four selected case study areas under investigation are largely representative of dryland and irrigation farming for both summer and winter rainfall regions in South Africa.

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Projections for the Hoedspruit area

Results from Dr Oosthuizen's assessment of the Hoedspruit area show that local mango and citrus farmers can expect their profits to shrink along with seasonal shifts in rainfall and an increase in average temperature. Farmers with high debt ratios will be more financially vulnerable than those with low debt levels.

Farmers might see quality losses and a reduced fruit set, while the need to irrigate will increase. Irrigation water comes mostly from the Blydepoort Dam where the water supply from the dam's catchment areas seems to be relatively assured.

"The erection of shade netting as an adaptation strategy will reduce financial vulnerability to climate change in the Hoedspruit area," is Dr Oosthuizen's advice. "The capital cost of these structures is, however, high and it may not be affordable to all farmers. In order for the investment to be economic viable and financially feasible, all aspects of management should be at a high level. Gradual implementation over a period of time will also contribute to the feasibility of implementing the shade netting adaptation strategy."

Farmers also need to effectively manage their irrigation systems and conserve soil water while cultivar breeding should focus to increase natural heat resistance."

Vredendal area

Vredendal in the Western Cape's winter rainfall area is a water stressed region where water supply is never certain. Based on Dr Oosthuizen's modelling results, farmers should prepare for a decrease in grape yield and an increase in the need to irrigate. Changing climates may require farmers to plant cultivars that are more tolerant towards projected climate change.

Shade nets may reduce the impact of climate change on yield and the quality of table grapes. Soil preparation and site selection for future plantings are crucial in order to ensure optimum production. Improved soil water management can improve profitability.

Moorreesburg areas

Dryland grain farming dominates the Moorreesburg area in the Western Cape's winter rainfall area. Pastures and small livestock are also kept to produce mutton and wool. No major changes in yield are expected for the intermediate future.

Dr Oosthuizen emphasizes that the models he used show that crop rotation and use of conservation agriculture techniques will enhance profitability and sustainability.

Carolina area

Dryland farming dominates the local agricultural endeavours around Carolina, in Mpumalanga's summer rainfall area. Maize, soybeans, sugar beans, mutton and beef production are the main enterprises.

The models show that local farmers can expect an increase in yield over the long term. This goes hand in hand with increased temperature and increased rainfall. Dr Oosthuizen warns that although all indicators point to increased profitability, the models he used cannot project extreme events such as floods or the impact of pests and diseases.

"It will do Carolina farmers good to follow a 'no regrets' strategy that involves crop rotation and conservation agricultural practices," he advises. "This will have a positive impact on profitability."

How was the research done?

Dr Oosthuizen first based his crop yield modelling on climatic data sets made available by the Climate Systems Analysis Group (CSAG) of the University of Cape Town. These data sets were also used to project future dam levels, the availability of irrigation water and future crop irrigation requirements. During the modelling phase a new technique, the Crop Critical Climate Threshold (CCCT) technique, was developed to enable the researchers to model crop yield and quality under different climate sets.

Shade nets, such as these, may reduce the impact of climate change on yield and the quality of table grapes.