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LEADING EDGE

Leading Edge, supported by the Society for Engineering in Agriculture and the Australian Centre for Precision Agriculture, provides a local and worldwide window on engineering and PA research.

Bringing satellites to earth for better crop estimates

By Gary Alcorn

Current research into blending low-cost satellite imaging with existing regional crop yield forecasting could mean shorter queues at grain depots and lower handling charges for growers.

Using an entire shire as a test bed, Toowoomba-based remote sensing scientists and agronomists are marrying NASA's Moderate Resolution Imaging Spectrometer (MODIS) imagery with the Qld Department of Primary Industry's Regional Crop Forecasting System (RCFS).

Team leader and Geographical Information Systems specialist Dr Armando Apan from the University of Southern Queensland's Faculty of Engineering and Surveying is quite optimistic about the project.

"Using special imaging which is supplied free from NASA's Terra and Aqua satellites we are designing and testing systems to enable accurate calculation of total winter and summer crop areas.

"The QDPI's RCFS uses agro-climatic yield models based on soil and crop data plus climate forecasting systems to estimate crop yields in wheat as tonnes per hectare.

"When we combine these data sources we can estimate the likely total production from any district. This has major implications for optimising grain storage, marketing, transport and planning," he said.

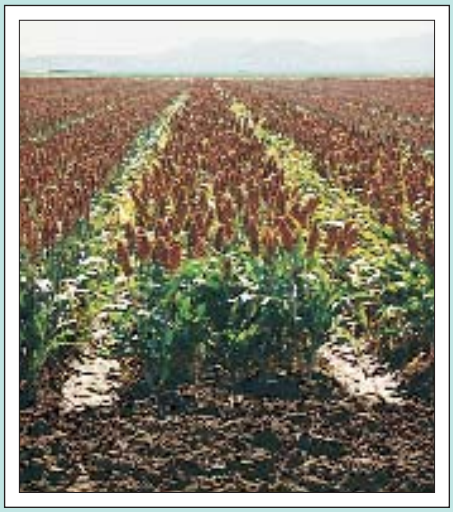
This joint DPI-USQ research project is comparing:

- The extent of crops mapped from MODIS 250m and Landsat7 images; and,
- The classification accuracy of the maps generated.

For the technically-minded the Landsat7 satellite has 30 metre resolution but only traverses Queensland every 16 days and costs $18,000 each time to map the cropping regions of the entire state.

The MODIS system has a top resolution of 250 metres, covers the same area every one to two days and offers free image download service from the ACRES website *(www.ga.gov.au/acres/)*. Its swath width is 2300 km.

According to Armando the current comparison of the two imaging systems using the rich Jondaryan Shire on the eastern Darling Downs is producing very encouraging results despite the coarser resolution provided by MODIS.



Research is looking at how to use MODIS for crop identification. Sorghum is the initial target crop.

"As you can see in the satellite images (Page 39), most of the cultivation areas in the 146,013 hectare shire are stripcropped. Those strips of sown crops and stubble or fallow area vary in width from 25 to 200 metres.

"Even though the MODIS uses a 250 metre pixel size it is remarkably accurate when compared with the 25 metre Landsat images," he said.

The research team which includes Dr Rob Kelly and Andries Potgieter (DPI) has been checking the satellite imaging accuracy in the field by ground-truthing with field data aided by GPS equipment.

Interpretation of various visible and invisible electromagnetic radiation wave-

TABLE 1: Classification accuracy

Classified NDVI image	Sample pixels	Correctly classified pixels	Overall accuracy (%)	Kappa coefficient
Landsat7	7590	7118	97.73	0.95
MODIS 250m	7590	7418	93.78	0.86

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lengths is the secret of estimating crop type and stage of development.

Previous work has found that Normalised Difference Vegetation Index (NDVI) image is highly correlated with biomass, greenness and per cent ground cover.

But reliable crop identification using remote sensing remains elusive, with wheat and barley offering the same data readout at this stage.

Sorghum is the target crop in the current project.

Using ISODATA clustering techniques, areas labelled 'crop' and 'non-crop' have been defined (Table 1).

What are the implications of this result?

This MODIS map clearly shows stripcropping in the Jondaryan shire.

• MODIS has a great potential in this area of remote sensing and regional crop production forecasting;

• The next step is to be able to identify crops (sorghum vs. cotton, vs. corn, etc.) which will be a PhD student project next year;

• Different time frames, for example weekly might be as useful; and,

• This sensing system could be used to map native vegetation units, estimate areas cleared and detect loggable species (such as the SLATS project).

Acknowledgements: USQ engineering student Brett Coppard, Dr Alex Held (CSIRO) and Dr. Stuart Phinn (UQ) for some advice on processing MODIS data.

THE MAIN POINTS

- Although different in resolution, MODIS has an accuracy comparable to Landsat7 in mapping crop areas;
- Mapping crops and non-crops produced high classification accuracy from both MODIS 250m and Landsat7 systems; and,
- MODIS has a high potential for crop mapping and monitoring.