Remote sensing and agricultural statistics: the impact of new sensors.

Francisco Javier Gallego, Raúl López
Joint Research Centre of the EC, Ispra, Italy – javier.gallego@jrc.ec.europa.eu
Joint Research Centre of the EC, Ispra, Italy – raul.lopez@jrc.ec.europa.eu

The techniques to exploit satellite images for of agricultural statistics have not changed much since the 80's. The number of countries that operationally integrate remote sensing on the estimation process might be even lower than in the early 90's. The panorama is better for yield forecasting and early warning, where time series of spatially coarse resolution images are operational in many international programs. Some major questions are: which are the key limiting factors? Availability, quality and price of satellite images?, classification algorithms? Estimation methods? Which types of satellite images are most important for agricultural statistics?

A large number of Earth Observation (EO) satellites have been launched in the last 20 years. Their presence in everyday life is massive. Most of the new sensors in orbit belong to the category of optical Very High Resolution images (VHR), with a pixel size often $\leq 1\ m^2$. Unfortunately VHR images have limited application for agricultural statistics. The main limitation of VHR images is the high cost and complicated management of full coverages with such images. A natural alternative is using samples of VHR images, but their cost-efficiency is very low. The "equivalent number of unclustered points" of clusters with a size compatible with VHR images, leaves little hope for the economic efficiency of VHR images.

A sound application to crop area estimation requires in general a nearly-full spatial coverage of images. This can be reasonably reached with medium resolution images (pixel size between 10 and 60 m). The most frequently used images are still the Landsat images. The current Landsat 8 OLI (Operational Land Imager) that slightly improves the first TM (Thematic Mapper) sensor onboard Landsat 4, launched in 1982. Landsat images are the standard benchmark to assess the cost-efficiency application to agricultural statistics, especially since they became free to download. The paper compares the potentiality of other medium resolution images with Landsat TM-OLI.

Coarse or moderate resolution images (usually $\geq$ 250m) have been proposed for area estimation, but there is little evidence that coarse images from the current year provide better efficiency than a good stratification. Although they are the most clearly operational images for agricultural monitoring, the efforts to renew these sensors is small. This is serious because the time dimension is more important for coarse resolution than for other types of images.

Synthetic Aperture Radar (SAR) is an always-promising family of images. Thanks to its ability to acquire images through clouds, they have been always seen as the alternative to optical images in cloudy areas. However, the poor signal to noise ratio has limited agricultural applications to paddy rice thanks to the very distinct response of flooded land. The newly available (since October 2015) SAR images of Sentinel 1 seem to have dramatically improved the signal to noise ratio and we might be in front of a turning point with regard to the usability of SAR images for agricultural information.

Keywords: Crop area estimation, Yield forecasting, Satellite images.