Improved potato monitoring in Belgium using remote sensing and crop growth modelling

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LAND USE

INTRODUCTION

Potato processors, traders and packers largely work with potato contracts. The close follow up of contracted parcels is important to improve the quantity and quality of the crop and reduce risks related to storage, packaging or processing. The use of geo-information by the sector is limited, notwithstanding the great benefits that this type of information may offer. At the same time, new sensor-based equipment continues to gain importance and farmers increasingly invest in this new technology.

The iPot project, financed by the Belgian Science Policy Office (Belspo), aims at providing the Belgian potato processing sector, represented by Belgapom, with near real time information on field condition (weather-soil), crop development and yield estimates, derived from a combination of satellite images and crop growth models.

REMOTE SENSING

A multi-scale approach is used for potato monitoring and yield estimation, integrating field observations and close range sensing measurements with UAV and satellite images and crop growth models.

During the cropping season regular UAV flights (RGB, 3x3 cm) and high resolution satellite images (DMC/Deimos, 22m pixel size) were combined to elucidate crop performance at variety trials. UAV images were processed using a K-means clustering algorithm to classify the crop according to its greenness at 5m resolution. Vegetation indices such as %Cover and LAI were calculated with the Cyclopes algorithm (INRA-EMMAH) on the DMC images (Fig.1).

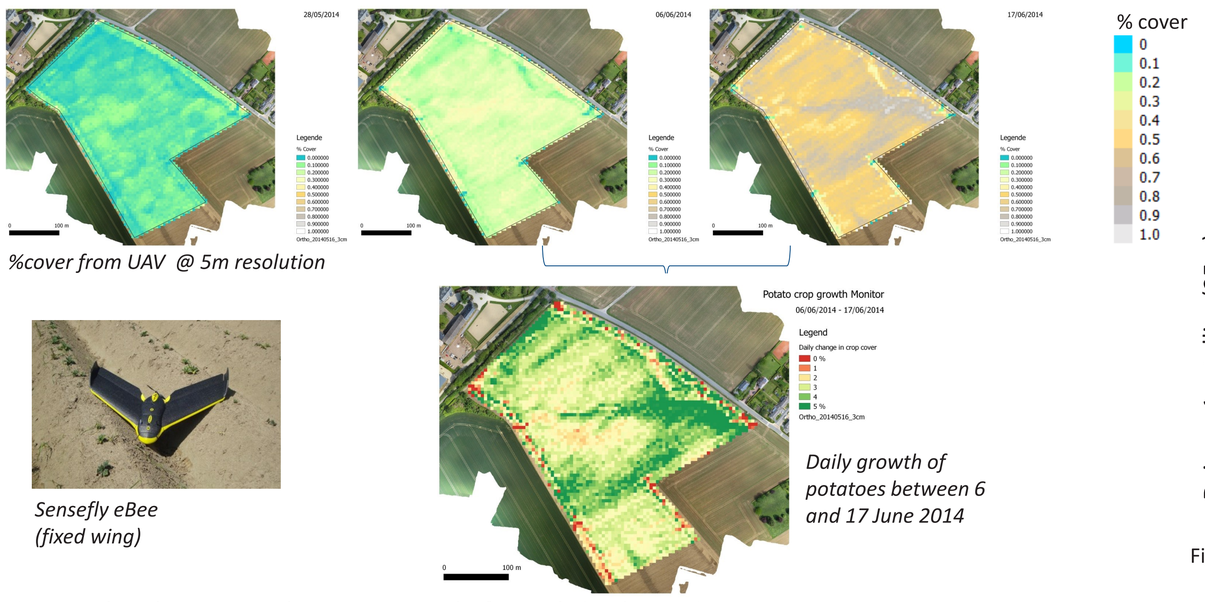
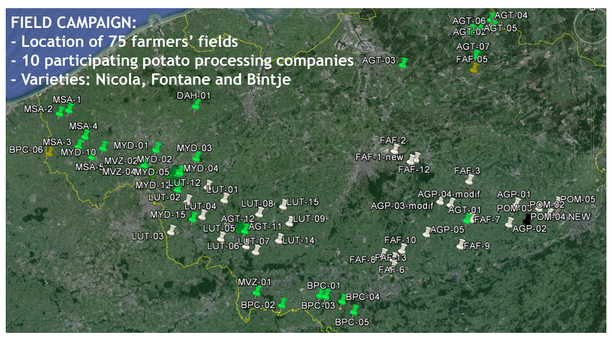


Fig.1. UAV-based cover maps demonstrate growth of cover during the growing season.

PHENOLOGY

Understanding and predicting crop phenology and canopy development is important for timely crop management and ultimately for yield estimates. A wide spread field monitoring campaign with crop observations and measurements allowed for further calibration of the satellite image derived vegetation indices. Curve fitting techniques and phenological models were developed and compared with the vegetation indices during the season, both at the trials and farmers' fields.



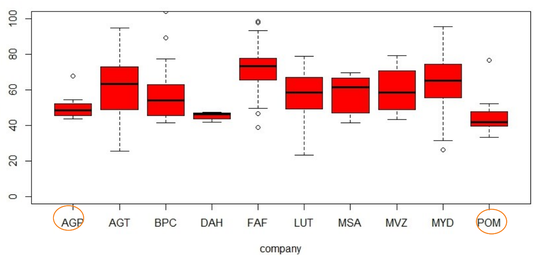


Fig.3. Yield differences between participating companies. Circle is variety Nicola , a potato for the fresh market.

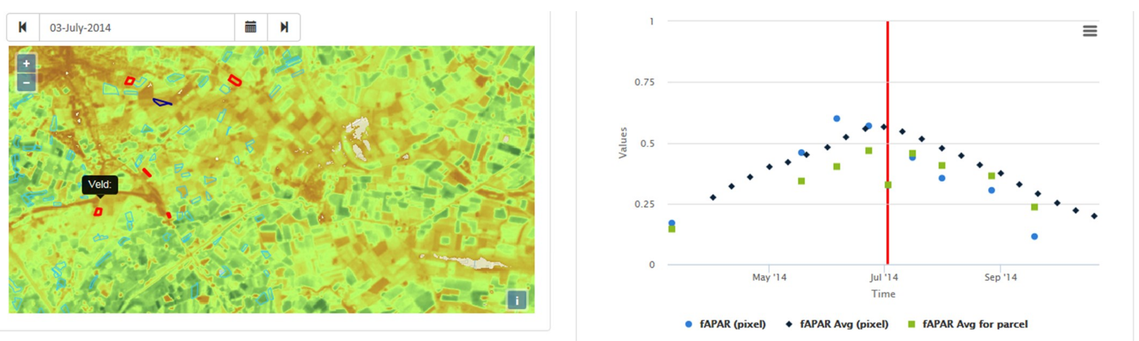


Fig.5. iPOT webtool, composed of different dashboards to enable field location and extraction of satellite information.

RESULTS

Both DMC and UAV-based cover maps showed similar patterns, and helped detect different crop stages during the season (Fig.2).

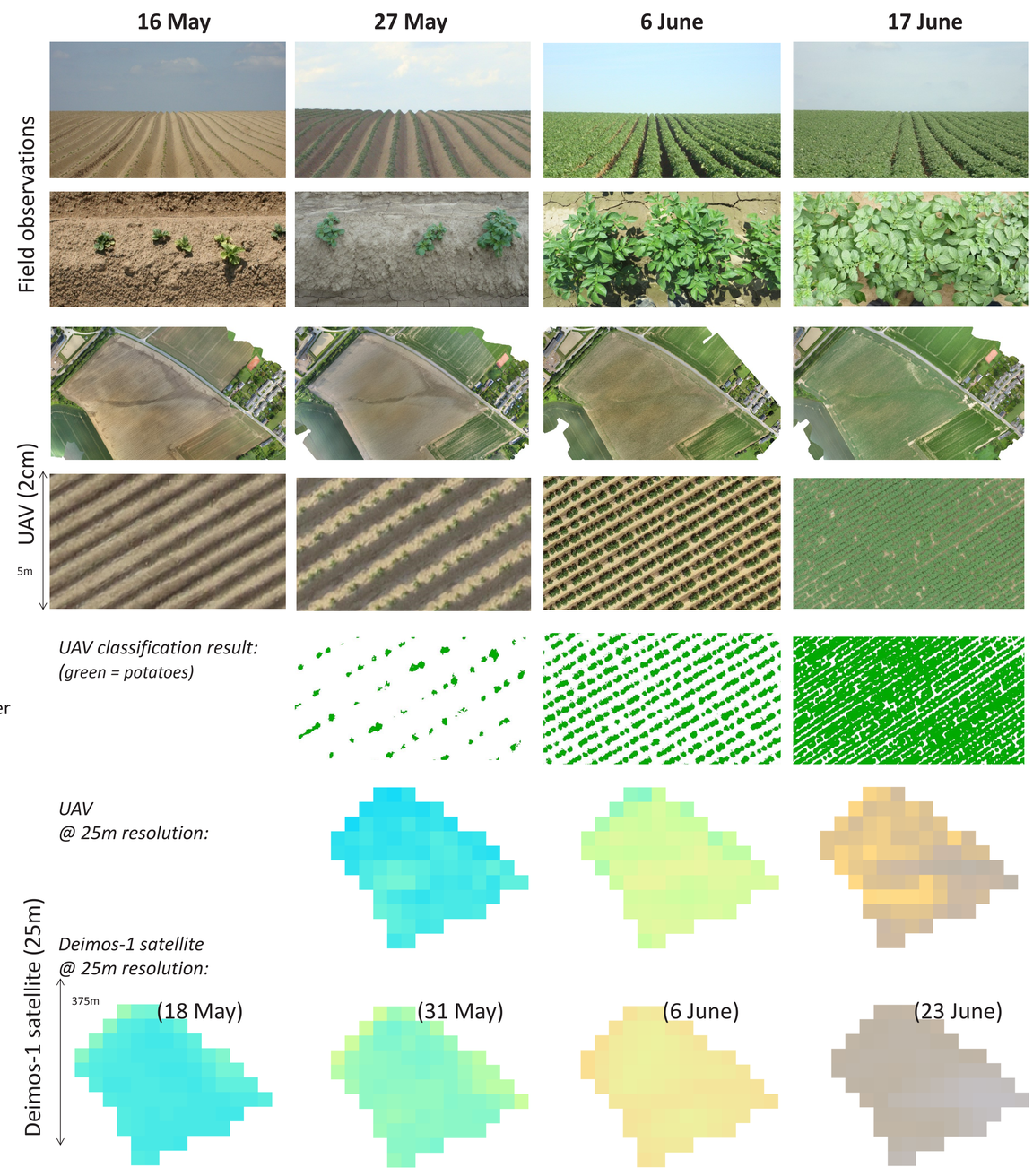


Fig. 2. DMC and UAV-based cover maps correspond to field observations during the growing season.

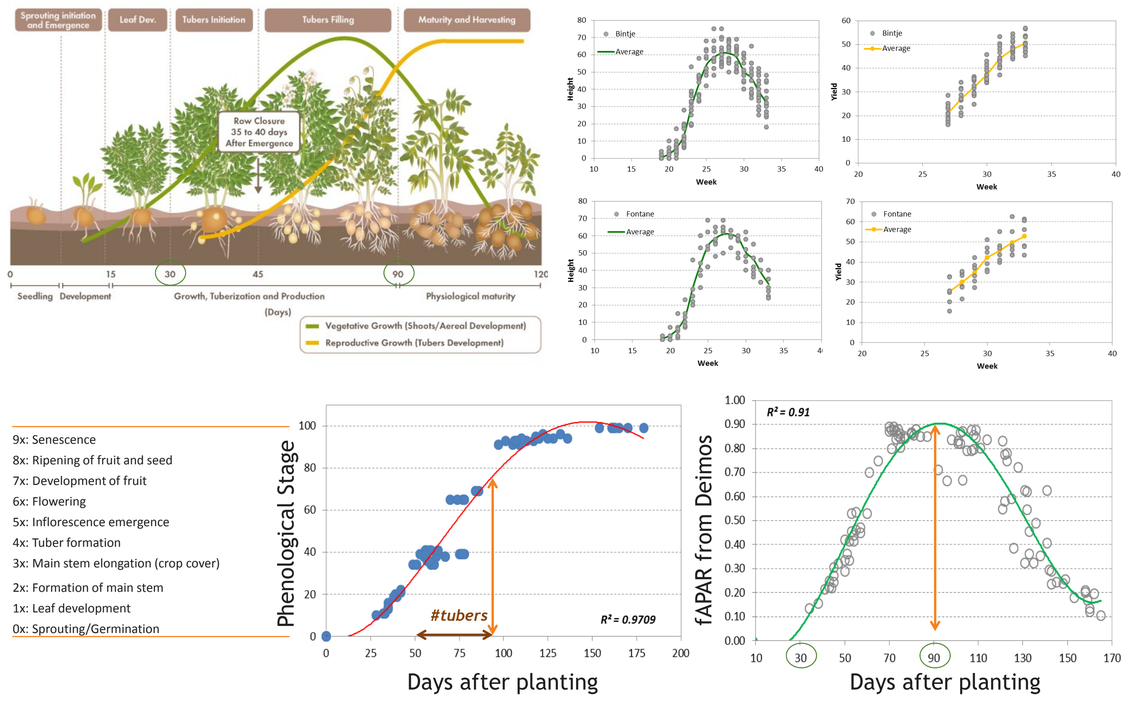


Fig.6. Phenological development of Bintje and Fontane (top) and correspondence of field phenology observations with satellite derived fAPAR (bottom).

CONCLUSION

The combination of geo-information and crop modelling strengthens the competitiveness of the Belgian potato sector in a global market. A web-based geo-information platform with different dashboards is developed to allow the Belgian potato industry and research centres to access, analyse and combine the data with their own field observations for improved decision-making.

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