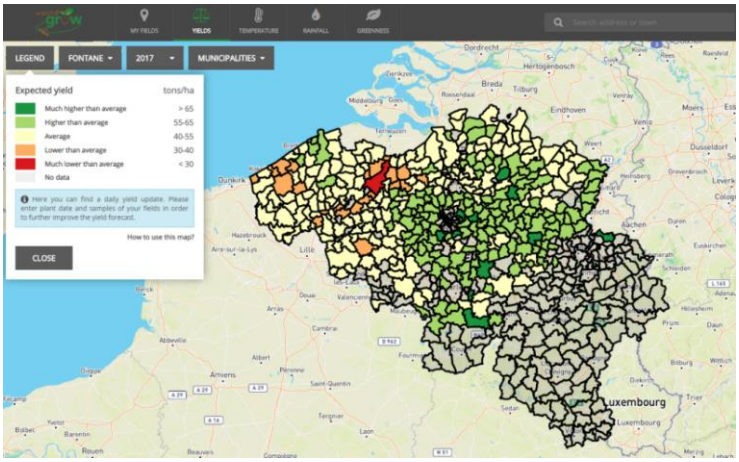
YIELD ESTIMATION



Example Image (watchitgrow.be)

CATEGORY

☒ Product Development ☐ Product Sales ☒ Underwriting ☒ Loss Adjustment ☒ Claims Handling

DESCRIPTION

EO based yield models are integrators of various data sources, for example vegetation indices to estimate the crops' phenology and meteo data derived from weather satellites. Several methods exist to estimate yield from EO data. Operational initiatives exist such as the EU Joint Research Centre (JRC) Mars Crop Yield Forecasting System (MCYFS), using agro-meteorological modelling (Crop Growth Monitoring System, CGMS) and statistical analysis tools. At local level, operational yield estimates at the farm level are available from commercial service providers. Besides the operational applications, a wide spectra of crop models is available which use EO data as inputs. A commonly used is the SAFY model of CESBIO (Duchemin et al., 2008).

Yield estimation models (for a wide variety of crops) are among the key priorities of the global agricultural insurance sector, as insuring yield may be referred as all-peril crop insurance. Existing pilot models continue their development while service providers are calibrating yield estimation models with in-situ data applying machine-learning and other technologies (e.g.: rice (Philippines, Indonesia, China)).

Combination of other EO services (e.g. field delineation, crop identification, NDVI, etc.) with yield estimation models provides a broad range of applications in all agricultural insurance business processes and product cycle activities. Being important at all product cycle stages, it is highly important for a more robust underwriting and loss adjustment processes.

PRODUCT SPECIFICATIONS

Main processing steps	Yield estimation is generally based on either machine learning (e.g. deep learning) and/or process-based (i.e. crop growth models) modelling approaches. Both can make use of a range of input data sources including satellite imagery time-series (e.g. of vegetation indices and derived parameters e.g. emergence date) and meteorological data along with environmental parameters such as soil and crop type. Process based models also allow different scenarios to be simulated, e.g. with or without water- or nutrient stress.
Input data sources	Optical: Sentinel-2 Radar: Sentinel-1

	Supporting data: in-situ calibration data (yield statistics, crop cutting experiments…)
Spatial resolution and coverage	Spatial resolution: 10m Coverage: Farm level till Watershed scale Availability: globally available
Accuracy / constraints	Thematic accuracy: depending on region and availability of in situ data Spatial accuracy: field level
Limitations	There are still no globally applicable yield forecasting models, mainly local pilots.
Frequency / timeliness	Frequency: daily Timeliness: near real-time
Delivery / output format	Data type: yield estimates (ton/ha). GIS-ready data formats; regional summaries, statistics, report sheets; API (depending on customer needs) File format: parcel level aggregated values (e.g. CSV)
Accessibility	Commercially available on demand from EO service providers.

CHALLENGES ADDRESSED – USE CASE(S)

Product Development:

- Index insurance: Risk / crop modelling (Correlation of EO data with in-situ data)
- Index insurance: Relation between weather events and impact on crop productivity
- Index insurance: Parcel/Field and regional yield statistics
- Elaboration of crop profile: Field crops, vegetables, horticulture, greenhouses

Underwriting:

- Seasonal portfolio monitoring
- Online platforms or easy-to-use interfaces integrating various data sources (e.g. vegetation stress, field boundary changes, comparison, etc.)
- Risk / crop zoning
- Identification of vegetation stages (identify most sensitive stages when crop is the most vulnerable to a risk, e.g. flowering stages)

Loss Adjustment:

- Benchmark physical field observations against yield loss detection (e.g. product calibration)
- Risk-mapping against crop's vegetation stages
- Increase credibility of loss adjustment (e.g. show EO data/visualization to support loss adjustment communication to farmer)
- Enhance field survey (better precision with EO data support)
- Assess crop damage at field level
- Distinct field heterogeneity with crop damage

Claims Handling:

- Identification of actual damage size (tons (volume) / ha (area)
- Quality control assessment of claims before pay-out
- Fraud detection
- Obtaining timely, reliable and consistent data to speed-up the indemnity pay-outs