Precision Viticulture, State of the art and perspectives

adapted from

Viticulture de précision® :
Etat des lieux dix ans après son avènement

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Presented for

5e Journée scientifique de la vigne et du vin
Introduction

• **1990 - Beginning of precision agriculture**
  - A significant development with cereals in France
    - (GPS guidance) 50 % des exploitations céréalières,
    - Support to N fertilization (600 000 ha using Remote Sensing),

• **2000 - Adaptation to viticulture (VP)**
  - 10 years of feedback to identify:
    - failures and setbacks,
    - factors of adoption,
    - evolutions and perspectives,
    - issues for scientists and professionals.
First examples of embedded systems for VP

- First yield sensors provided by equipment manufacturers (in the same way as for cereals),
- A first revolution.

- Localisation by DGPS,
- Embedded measurement systems,
- Possibility of high resolution (m) mapping

Sources: Agro-Montpellier/Pellenc S.A.
Surface: 1.2 ha.
Feed back

• A rather mixed review:
  – Adoption by a few number of big companies (Southcorp- Australie, San Pedro-Chili, Raïmat/Torres-Espagne),
  – Only one manufacturer (ATV),

• Factors of adoption:
  – Whole fleet equipped in the same way,
  – One specialist in geoscience (dedicated to data treatment and maintenance),
  – Interest of executives and share-holders in terms of reporting tools,
Feed back

- A rather low interest of other structures
  - For traders/coop. wineries
    - Heterogeneity of supplies and types harvesters (the whole domain is not mapped),
    - Difficulty to collect and consolidate heterogeneous data,
  - For producers/vineyard
    - Necessary skills and investments,
    - Low value information of crop monitoring (end of production),
    - No reference for the use of this information,
    - Low interest for high added value vineyard (manual harvest).
Towards new observation systems

• New spécifications:
  • Getting data during the whole production cycle,
  • Building Decision Support tools.

• Common aspects
  • Geo-referenced data and time record,

• Typology of data needed
  • Spatially high resolution,
  • Temporal high resolution,
  • Intermediate tools.
Towards new observation systems

• **Spatially exhaustive information**
  • Vegetation mapping by remote sensing,
    Instant view of the whole production system
    (ex. Oenoview® -ICV-Astrium)

- Information during the production cycle,
- New applications
  - Plot sélection
  - Adapted management,
  - Adapted harvest,
  - Selective sampling,

Aerial photography, false color - 1 m²,
(source Oenoview, ICV, Astrium, Avion-Jaune, Pech-Rouge)
Towards new observation systems

- Spatially high resolution information
  - Vegetation mapping by proxy-detection
    - grass management in vineyard
    - ultimately, real time adjustment of rates of herbicide

Several commercial solutions
- Greenseeker™ (Ntech)
- Cropcircle © (NZ)
- GrapeSense (Lincoln Venture-NZ)

Drissi et al., 2009
Towards new observation systems

- Spatially high resolution information
  - Phyto-product application follow-up and traceability
    - A posteriori checking of the spray results and spatial efficiency
    - Expected lower environmental impact and economical savings

Tixad  www.tixad.eu

Sources: IRSTEA, TICSAD
Towards new observation systems

- Spatially high resolution information
  - Mapping of soil conductivity,
    - Decision support for optimized sampling design before harvest
    - Decision support for crop management (plantation, treatment)

Géocarta

Sources: www.geocarta.net
Towards new observation systems

- Temporally exhaustive information spatially punctual
  - Follow-up of the production system (climate, soil water, water demand)
  - Multi-sensors network (GPRS, ZigBEE, etc.),
    - Water supply /water stress monitoring,

Many enterprises:
- Agriscope,
- Fruition science,
- TCSD,
- Verdtech, etc.
Towards new observation systems

• Hand-held sensors
  • Non destructive grape maturity monitoring to decide on optimised harvesting date (Ex. Spectron)
  • Vine physiological status monitoring for optimised application of factors of production (ex. Multiplex)
  • Yield and quality prediction (ex. Qualiris grappe)

SPECTRON™
Pellenc, Cemagref, IFV

Qualiris grappe™

Multiplex™
Force-A

www.pellenc.com
www.sodimel.fr
www.force-a.eu
And furthermore

- Link with winery tools and information systems
  - grape quality monitoring at reception (Qualiris reception™)
  - assess cleanliness, integrity and colour of the grapes

Qualiris reception™

www.sodimel.fr
Ongoing research on VP

• **Measurement**
  - Optical properties (ex Spectron),
  - Remote sensing (ex Oenoview),

• **Embedded systems**
  - Spraying traceability (ex. Tixad),
  - Smartphone applications (ex. smartGrape, Vinonomade)

• **Data processing and translation**
  - GeoFis (freeware for geodata processing),
  - Spider (method of water stress interpolation),
  - Spatial sampling methods,
Ongoing research on VP

Pre-harvest grape quality monitoring

Operational constraints:
- 30 plots visited /day,
- Support with geolocallized Smartphone,
- Best localisation of measures?

Oenoview

Smartphone, Pocket-PC

Online sampling design
Conclusions

• Issues of
  – Spatial heterogeneity assessment (traceability, logistic)
  – Vegetation mapping (crop management)
  – Phyto-product application monitoring (Env & econ impacts)
  – Soil mapping
  – Follow-up of water and physiological status (water/N supply monitoring)
  – Follow-up of production and quality (harvest forecast and wine quality monitoring)

• Trend for hand-held, stand alone sensors
  - High value information, rather expensive sensors vs.
  - Simple lower value application available on Smartphone
Issues for the viti-viniculture sector

• Joining geographic and temporal information
  • Interpolation
  • Sampling design

• Inter-operability
  • Communicating systems
  • Data exchange standards
  • Integration of new tools in existing systems,

• Links with robotics
Thank you for your attention

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