Overview CGMS and related tools

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This introduction presents an overview of the contents of this special issue of VIAS. It will briefly introduce the different components of the MARS Crop Yield Forecasting System (MCYFS) with a focus on the agro-meteorological information system CGMS (Crop Growth Monitoring System) and related tools such as a statistical tool for crop yield forecasting and viewers. Finally, for an overview of the historic background of the CGMS project you are referred to the article by Van Diepen and Boogaard (this issue).

The Crop Growth Monitoring System CGMS

The main purpose of CGMS is to estimate the influence of weather conditions on crop growth and yield on regional scale (provinces, countries, continents). Therefore, CGMS combines aspects of both weather data processing and collection as well as modelling crop growth and development. First of all, daily weather station records are collected, quality checked and interpolated to agro climatic zones. These weather data are used as input in the crop growth model but also provide weather indicators that are of value for interpreting the crop growth conditions such as extreme weather events (Figure 1, left column).

In the second level, the interpolated weather data are combined with crop data (management, variety) and soil data (hydraulic properties) to simulate the growth and development of crops using the WOFOST model for arable crops (Van Keulen and Wolf, 1986; Boogaard et al., 1998) and the LINGRA model for grassland crops (Schapendonk et al., 1998). These models provide estimates of biomass and yield at a daily time step for different crop types over a range of agro-environmental conditions. The simulation results are directly usable for crop-specific qualitative monitoring of the growing season (Figure 1, second column) but are also input for crop yield forecasting. More background on history and recent development of crop growth models can be found in the article of Wolf and van Ittersum (this issue).

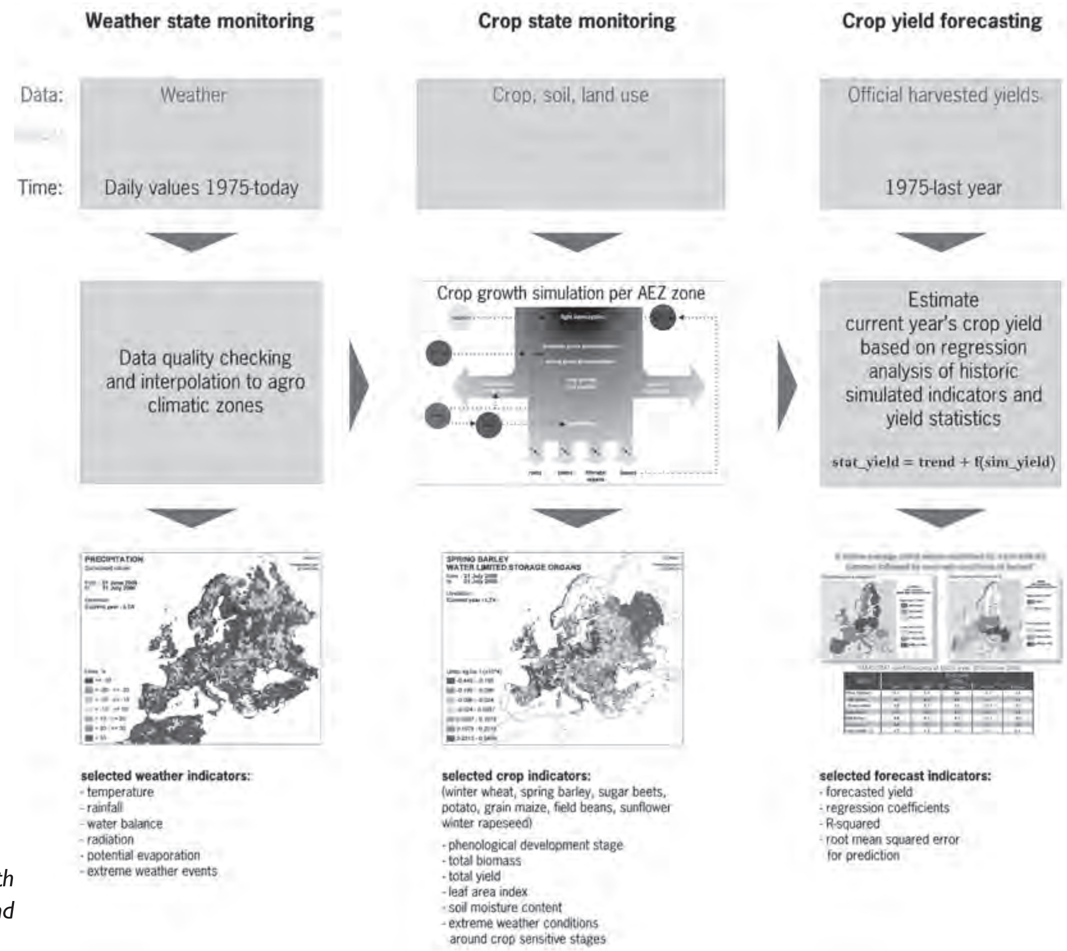
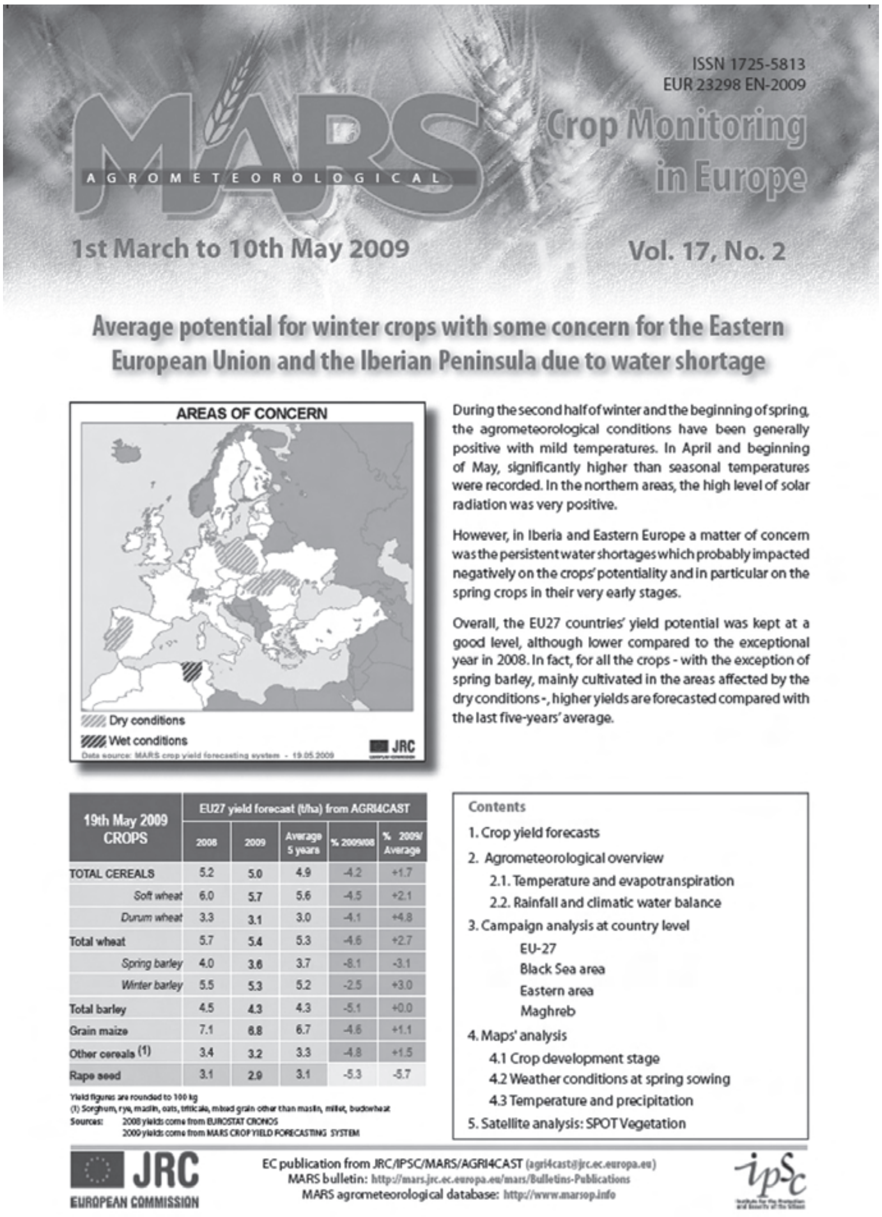


Figure 1 Overview Crop Growth Monitoring System (CGMS) and yield forecast module



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Average potential for winter crops with some concern for the Eastern European Union and the Iberian Peninsula due to water shortage

AREAS OF CONCERN

Dry conditions

Wet conditions

Data source: MARS crop yield forecasting system - 19.05.2009

JRC

During the second half of winter and the beginning of spring, the agrometeorological conditions have been generally positive with mild temperatures. In April and beginning of May, significantly higher than seasonal temperatures were recorded. In the northern areas, the high level of solar radiation was very positive.

However, in Iberia and Eastern Europe a matter of concern was the persistent water shortages which probably impacted negatively on the crops' potentiality and in particular on the spring crops in their very early stages.

Overall, the EU27 countries' yield potential was kept at a good level, although lower compared to the exceptional year in 2008. In fact, for all the crops - with the exception of spring barley, mainly cultivated in the areas affected by the dry conditions -, higher yields are forecasted compared with the last five-years' average.

19th May 2009 CROPS	EU27 yield forecast (t/ha) from AGRI4CAST				
	2008	2009	Average 5 years	% 2009/08	% 2009/ Average
TOTAL CEREALS	5.2	5.0	4.9	-4.2	+1.7
Soft wheat	6.0	5.7	5.6	-4.5	+2.1
Durum wheat	3.3	3.1	3.0	-4.1	+4.8
Total wheat	5.7	5.4	5.3	-4.6	+2.7
Spring barley	4.0	3.6	3.7	-8.1	-3.1
Winter barley	5.5	5.3	5.2	-2.5	+3.0
Total barley	4.5	4.3	4.3	-5.1	+0.0
Grain maize	7.1	6.8	6.7	-4.6	+1.1
Other cereals (1)	3.4	3.2	3.3	-4.8	+1.5
Rape seed	3.1	2.9	3.1	-5.3	-5.7

Yield figures are rounded to 100 kg
(1) Sorghum, rye, maslin, oats, triticale, mixed grain other than maslin, millet, buckwheat
Sources: 2008 yields come from EUROSTAT CRONOS
2009 yields come from MARS CROP YIELD FORECASTING SYSTEM

Contents

JRC EUROPEAN COMMISSION

EC publication from JRC/IPSC/MARS/AGRI4CAST (agri4cast@jrc.ec.europa.eu)
MARS bulletin: http://mars.jrc.ec.europa.eu/mars/Bulletins-Publications
MARS agrometeorological database: http://www.marsop.info

Figure 2 Screenshot of a recent MARS Europe bulletin

Crop yield forecasting

Finally, in the third level crop simulation results are aggregated to regions (provinces and countries) and used in the crop yield forecasting module to produce a quantitative yield forecast (Figure1, third column). Through CGMS the influence of weather on crop growth and yield is analyzed. However, the approach assumes implicitly that the influence of all factors other than weather (e.g. farm management, socio-economic conditions) are constant. Hence, the final synthesis of MCYFS, done by JRC, includes also other sources of information such as remote sensing image derivatives. Therefore, a crop yield forecasting module (CGMS Statistical Tool) has been developed which is flexible in the sense that also information from other sources can be drawn into the analysis. For a detailed description of the CGMS Statistical Tool see the article by Hoek et al. (this issue).

Visualization of results

Weather indicators, crop indicators and yield forecasts are stored in an ORACLE spatial database. To analyze the indicator values, both in space and time, an advanced viewer is being developed. It will replace the current MARSOP web site (http://www.marsop.info). The viewer enables the analyst to evaluate weather and crop conditions of the current year in comparison with the long term average value. The paper by Lokers et al. (this issue) presents the viewer among other IT aspects of the CGMS. Nowadays the web site and regularly issued crop bulletins have become a vital information source for media and public, especially when extreme weather events occur (Figure 2).

Improvements and research

Except for the operational application of CGMS several improvements have been studied and implemented. They vary from spatial extensions to other continents, capturing short and medium term weather forecasts within the crop indicator estimates, an improved soil water module and possible use of remote sensing data. Currently remote sensing data are not used in CGMS but are part of a parallel infrastructure supplying vegetation indices of the current year in comparison with the normal. Current research activities focus on the inclusion of uncertainty in the system through probabilistic approaches and the assimilation of remote sensing data which is presented in the paper of De Wit (this issue).

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