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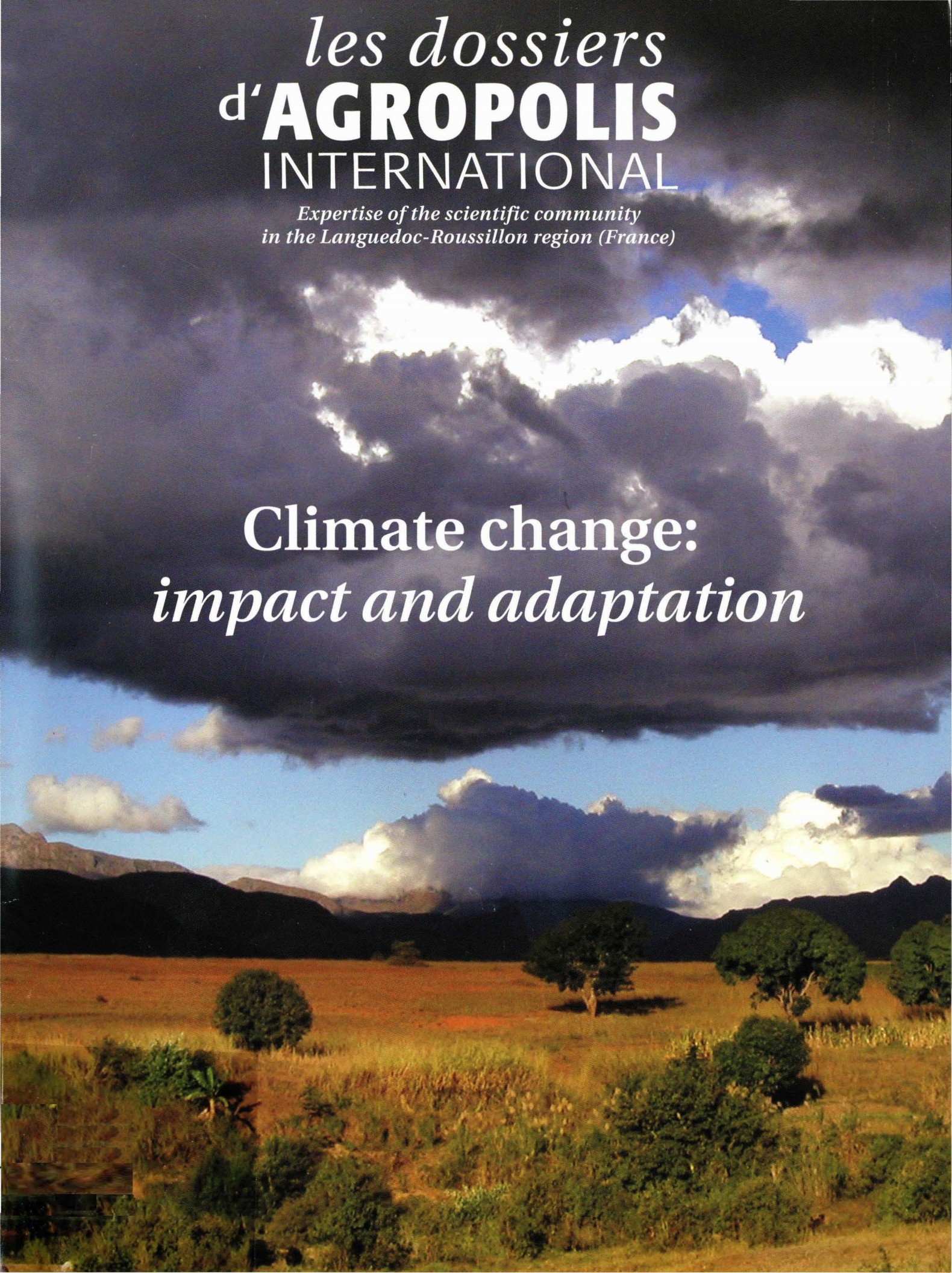
Expertise of the scientific community in the Languedoc-Roussillon region (France)

Climate change: *impact and adaptation*



Crop water balance and climate change

▼ *Crop residue left in the field.*

F. Baudron © CIRAD

Through field measurements combined with modelling, the Assessment of Annual Cropping Systems team of the AIDA research unit *(see page 74)* is further assessing the effects of conventional and innovative agricultural practices on the agricultural and environmental performance of crops. This assessment focuses especially on the impact of cropping practices on water usage. In some situations, the enhanced infiltration and reduction in evaporation achieved by leaving a mulch layer on the soil surface enhances cereal crop yields without increasing the interannual variability. However, in other situations (generally more humid conditions), the increased water infiltration only results in increased drainage but has little effect on crop yields, even though this practice contributes to reducing erosion problems.

Greater representation of these phenomena in crop models enables better *ex ante* quantification of the potential of innovative techniques designed to enhance adaptation to future climate change. These studies are currently being carried out as part of the Agroecology-Based Aggradation-Conservation Agriculture (ABACO) and Environmental and Social Changes in Africa: Past, Present and Future (ESCAPE) projects. The EU-funded ABACO project aims to evaluate and implement conservation agriculture and agroecology based technical solutions that are also designed to reduce soil degradation and food insecurity. The ANR-funded ESCAPE project assesses the vulnerability of rural societies in sub-Saharan African regions to climate and environmental changes, while studying adaptation strategies to reduce this vulnerability.

The AIDA research unit is contributing to this project particularly by assessing the potential impact of future climate change on cropping systems. These projects are being carried out in countries such as Burkina Faso, Madagascar and Senegal, and the scientific questions to which AIDA teams are proposing answers (via an *in silico* test on technical and organizational changes) are, for instance, "Could economic risks for farms be reduced through crop insurance assistance based on meteorological analyses?"

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Understanding plant responses to water stress to enhance performance in a climate change setting

Because of global change and the growing world demand for food, it is crucial to clearly understand how plants take up and utilize soil water and especially how cereal crops tolerate and react to water stress. These issues are studied through two research projects conducted by UMR B&PMP *(see page 81)*.

The HydroRoot project aims to boost our fundamental understanding of root water transport. This will provide an integrated view of roots by taking the hydraulic properties of tissues and the root architecture into account, and by explaining how these components are molecularly controlled by physiological and environmental parameters. Through the strong physiological and genetic components of this project, this type of research could also have an impact on plant improvement programmes geared towards generating plants featuring optimised water use and stress responses.

Leaf rolling resulting from leaf epidermal contractile cell movements is an adaptive response to water deficit that occurs in many cereals. The aim of the LeafRoll project is to identify molecular mechanisms responsible for turgor and contractility variations in these cells by focusing specifically on transmembrane ion fluxes.

Molecular, physiological and agronomic analyses will be conducted on a panel of wheat cultivars showing various degrees of drought tolerance and on lines with modified expression of genes coding for ion transport systems. The studies will assess the role of these genes in leaf rolling and wheat productivity under water deficit conditions.

S. Mahboub © *Université de Casablanca*

Y. Boursiac © B&PMP

This project is being developed in collaboration with the Ecology and Environment laboratory of the *Faculté des Sciences Ben M'sik* in Casablanca (Morocco), as part of a Hubert Curien Partnership of the French Ministry of Foreign and European Affairs.

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▲ *Leaf rolling in durum wheat plants under drought conditions. This decreases the leaf area exposed to sunlight, thus reducing tissue heating and water loss by transpiration.*

▶ *Schematic diagram of water flow paths in a plant root during its radial transfer from the soil to vascular tissues.*