



**PARCERIA EMBRAPA-FORSCHUNGSZENTRUM JÜLICH (IBG-2) PROGRAMA LABEX EUROPA/
ALEMANHA, EM NOVOS MÉTODOS NÃO-INVASIVOS APLICADOS A FENOTIPAGEM DE
PLANTAS**

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Resumo: A ciência de plantas e ciências agrárias estão no centro dos principais desafios para as sociedades globais. Relacionado a estes desafios o melhoramento de plantas não têm mantido ritmo do aumento de produtividade, assim sendo esforços urgentes se faz necessário para reduzir esse fator. O gargalo está na obtenção da informação quantitativa sobre as características complexas das plantas (Fenotipagem), de forma não invasiva, as quais são necessárias para enfrentar os desafios (interação meio-ambiente e genótipo). Os novos métodos não invasivos de fenotipagem de plantas exigem abordagens multidisciplinares e transdisciplinares, e a relação com pesquisadores e profissionais no uso da planta, geociência, ciência da computação e instrumentação. O programa Embrapa Labex Europa, com sede na Alemanha, foi criada pela Embrapa para estabelecer projetos na área e incentivar novas colaborações. Neste sentido, investigações com abordagens não-invasivas para ciências das plantas são consideradas estado da arte na fenotipagem.

Palavras-chave: novos métodos para fenotipagem de plantas, bioeconomia, Embrapa, Forschungszentrum Jülich

**EMBRAPA-FORSCHUNGSZENTRUM JÜLICH (IBG-2) PARTNERSHIP, LABEX EUROPE/ GERMANY,
IN NON-INVASIVE NEW METHODS APPLIED TO PLANT PHENOTYPING**

Abstract: The science of plant and agricultural sciences are at the center of the main challenges for global companies. Related to these challenges plant breeding have not kept pace increased productivity, thus urgent effort is needed to reduce this factor. The bottleneck is in obtaining quantitative information about the complex characteristics of plants (phenotyping), noninvasively, which are necessary to meet the challenges (environment interaction and genotype). The new non-invasive methods of phenotyping plants require multidisciplinary and transdisciplinary approaches, and the relationship with researchers and professionals in plant use, geosciences, computer science and instrumentation. The Embrapa Labex Europa program, branch Germany, was created to establish projects in the area and encourage new collaborations. In this sense, research on non-invasive approaches for the plant sciences is considered state of the art phenotyping.

Keywords: new methods to plant phenotyping, bioeconomy, Embrapa, Forschungszentrum Jülich.

1. Introduction

Agricultural and plant sciences are more than ever at the center of major challenges to global societies. The food challenge needs immediate solutions with more and more volatile food prices affecting specifically the poverty. At the same time long-term perspectives need to be developed to address issues related to the fact that 60% more biomass may be needed by 2050 to feed the increasing population (FAO). Scarcity of resources is becoming increasingly visible. Water is already a major limitation of agricultural production globally. It will become even more severe with the expected population increasing, agriculture intensifications, water quality issues, and with modifications of rainfall linked to climate change. Nutrients, like phosphate, have most likely reached peak production from concentrated mining resources, demanding alternative approaches to increase nutrient use efficiency and a reduction in the environmental footprint of agricultural production, whilst still being able to enhance yield per input.

In contrast to these urgent challenges efforts in plant breeding have not increased as needed and yield increases slow down. Novel approaches are needed to accelerate development and technology transfer. New breeding technologies based on improved knowledge about genetics and genotyping have a great potential. However, the bottleneck is quantitative information on the complex traits that are needed to tackle the challenges.

Phenotyping is the quantitative analysis of plant's structures and functions (FIORANI E SCHURR, 2013). Quantitative knowledge of phenotyping allows technology transfer from basic research to applied agriculture and ecological research.

A central parameter determining root system response to water availability is that water is usually not homogeneously distributed and this heterogeneity significantly increases, when drought stress occurs.

2. Materials and Methods

New methods applied to plant phenotyping requires multidisciplinary and transdisciplinary approaches and interaction of researchers and practitioners in the use of plant, geoscience, computer science and instrumentation. They open new windows to generate knowledge about plants and their environment. To screen for new varieties requirement often non-invasive methodologies including using the full spectrum of electromagnetic modes ranging from optical techniques like spectral reflectance and active methods to tomographic methods like computed tomography (CT), magnetic resonance imaging (MRI) or positron emission tomography (PET) are needed. (HERRMANN; SCHURR, 2013).

Low cost, light-weight, versatile instruments and sensors are devices that researchers from different areas are expecting in some applications. In this direction the investigation of non-invasive approaches to plant sciences are considered state-of-the-art when applied in phenotyping.

3. Results and Discussion

Forschungszentrum Jülich that is one of the world leaders in plant phenotyping sciences and the national Brazilian Agricultural Research Corporation (EMBRAPA) have joint forces in the LABEX Europe - Germany. During the last two years have been done many activities, as following below, the project of common interest (PCI), split in two blocks: Integration and Cluster. In the integration block is basically the project to development new sensors to measure 2D, volumetric soil moisture, in such way the non-invasive methodology, applied in rhizobox. The cluster block is to establish new partnership with Jülich Plant Phenotyping Center (JPPC) and Embrapa, by promoting interchange with researchers from Brazil and Germany, in plant phenotyping (PP), to develop the experiments in his facilities with new methods. In this block one colleague, from Brazil, already come here (Dra. Sylvia Morais de Souza Tinoco – Embrapa Maize and Sorghum) and other is planning to coming next year to FZJ/IBG-2 (Dr. Walter Quadros Ribeiro Junior - Embrapa Cerrados, as a visiting scientist program from Embrapa). In this list of activities were organized five (05) videoconferences (VC) between IBG-2 and more than 23 Embrapa units, about four different working groups in plant phenotyping. Using IT tools (e-mail list) was created a group list, with forty-eight (48) colleagues, from Brazil, to keep informed about new methods applied to plant phenotyping. A very important activity, as part of the mission of the Labex Europe-Germany, was participate of events, conferences, meetings, visiting places and trips (Travels). Two international workshops (WS) were organized in Brazil, with colleagues from Germany. As results from those two WS, were established the Labex Germany in Brazil and the starting point to write a white paper and a roadmap to the area, as the embryo of the Embrapa and Brazilian Plant Phenotyping Network (BPPN). It is also a key step to interact with the Jülich Platform Phenotyping Centre (JPPC), the German Plant Phenotyping Network (DPPN), European Plant Phenotyping Network (EPPN) and International Plant Phenotyping Network (IPPN). Important points were the visitors to IBG-2, not just from Embrapa, but the other institutions. Bioeconomy is a key issue in Germany, and they are discussion to new collaborations. The figure 1 is showing the illustration of the main activities.

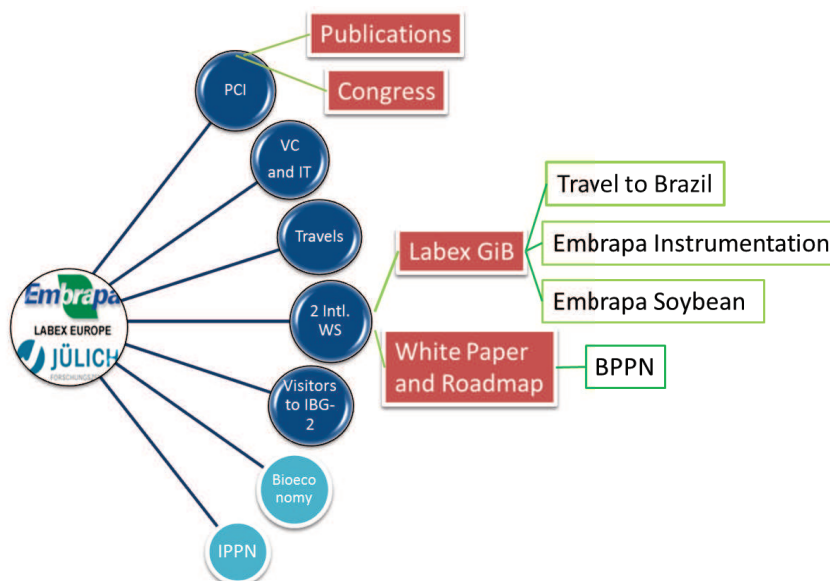


Figure 1. Illustration of the main achievements promoted by Labex Europe, Germany during 10/2012 to 09/2014.

In the table 1, are showing some numbers of Embrapa Labex Europe program, in Germany, during two years, since 10/2012 to 09/2014.

Table 1. Summary of the two years of the activities in numbers.

SCIENTIFIC	Numbers during the time (10/2012 to 09/2014)	
Project of Common Interest (PCI):	Creation of integration and cluster block	
Organization of the International Workshop.	02 (openness of new agreements)	
Lectures:	06 presentations, (besides that 04 were requested and 02 organized)	
Participation in seminars	12	
Events, conferences, meetings, visiting and trips	Germany: 17; Abroad: 24	
Abstracts and extended abstracts to the conferences:	11 (04 of them are specific results of PCI)	
Writing a book chapter:	01)	
Publication at International Journals:	Published: 06	
Advisor (in Brazil):	Pos-doc: 01; Doc.: 02; M.Sc: 01 (Concluded).	
Videoconference (VC):	Organized: 05 and Participation: 03	
Referee (scientific papers and projects):	07	
Inputs from Labex to the projects:	From Germany: 04	From Brazil: 06
MANAGEMENT		
Meetings about projects and PCI:	10	
German visitors to the Embrapa	07	
Visitor to FZJ / IBG-2 (from Embrapa):	04	
News to newspapers	12	

4. Conclusions

The collaboration with Embrapa is showing a very fruitful, and the results of activities were presented, as well as shown opportunities to new collaborations.

The national and international networks are key issues, and have coordinating by IBG-2: Plant Sciences. The FZJ/IBG-2 has dedicated their work to innovative and applicable concepts for plant phenotyping to address the huge challenge that the agriculture is facing today and in the future. This provides great opportunity for both to work together in these key technologies for the future, mainly create and establish the Embrapa and Brazilian international network.

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References

- FIORANI, F.; SCHURR, U. Future Scenarios for Plant Phenotyping, Annual Review of Plant Biology, v. 64, n. 1, p. 267-291, 2013;
- HERRMANN, P. S. P.; SCHURR, U. In: Humboldt Kolleg 2013 / SCIENCES & TECHNOLOGY IN CONTEMPORARY LIFE: IMPACTS AND HORIZONS, Campos do Jordão-SP. XII Brazilian MRS Meeting, 2013. p. 43-44.

