

# Functional Plant Biology

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### Research Front: Beans in the Tropics

*Foreword: Why not beans?*

*Anthony Cavalieri, Andrew Merchant and Elizabeth van Volkenburgh*    iii–vi

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*Viewpoint: Crop improvement in the era of climate change: an integrated, multi-disciplinary approach for common bean (*Phaseolus vulgaris*)*

*Phillip E. McClean, Jimmy BurrIDGE, Stephen Beebe, Idupulapati M. Rao and Timothy G. Porch*

927–933

Common bean (*Phaseolus vulgaris*) is an important nutritional crop in many countries of the world where it can provide up to 50% of protein intake. But currently its production is constrained by many factors related to climate change. This article describes a global research plan to maintain the productivity of common bean for the years to come that utilises resources from throughout the world.

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*Viewpoint: Polyols as biomarkers and bioindicators for 21st century plant breeding*

*Andrew Merchant and Andreas A. Richter*

934–940

New and improved analytical technologies have enabled the characterisation of plant metabolic networks at an unprecedented level of precision. The synthesis and occurrence of polyols offer considerable promise for use as bioindicators and/or biomarkers of plant function. Here we highlight the role(s) of polyols as a significant carbon sink and highlight their potential for use as integrated measures of plant function.

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Root responses to neighbouring plants in common bean are mediated by nutrient concentration rather than self/non-self recognition

*Eric A. Nord, Chaochun Zhang and Jonathan P. Lynch*

941–952

Plants are reported to over-invest in roots in response to neighbours. In bean, phosphorus concentration but not the presence of a neighbour changed root biomass. Root architecture responded to both factors. These results support the hypotheses that resource depletion rather than self/non-self recognition mediates below-ground interactions, and that root architecture can respond to neighbours without changes in root biomass.

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Investigation of the domestication of common bean (*Phaseolus vulgaris*) using multilocus sequence data

*Sujan Mamidi, Monica Rossi, Deepti Annam, Samira Moghaddam, Rian Lee, Roberto Papa and Phillip McClean*

953–967

The study of domestication in plants helps understand the origins and selective pressures on crop species. This study identified two independent domestication events, one in each gene pool of common bean with durations of ~1900 and 1500 years in MA and Andean respectively. With significant population structure, bottlenecks, and varied LD, association mapping is appropriate in each gene pool independently.

*Cover illustration:* (Top) Local market in Kampala, Uganda. (Bottom) A researcher at ISAR (Rwanda Agricultural Research Institute) tending a climbing bean trial in Nyagatare (located in an Eastern province). Photographs by Neil Palmer/International Centre for Tropical Agriculture (CIAT).

Non-invasive approaches for phenotyping of enhanced performance traits in bean  
**Uwe Rascher, Stephan Blossfeld, Fabio Fiorani, Siegfried Jahnke, Marcus Jansen, Arnd J. Kuhn, Shizue Matsubara, Lea L. A. Märtin, Andrew Merchant, Ralf Metzner, Mark Müller-Linow, Kerstin A. Nagel, Roland Pieruschka, Francisco Pinto, Christina M. Schreiber, Vicky M. Temperton, Michael R. Thorpe, Dagmar Van Dusschoten, Elizabeth Van Volkenburgh, Carel W. Windt and Ulrich Schurr**

968–983

Plant phenotyping is an emerging discipline in plant biology and describes the measurements of functional and structural traits to better understand the eco-physiological adaptation of plants to their natural environment. Phenotyping approaches aim for a non-invasive quantification of plant properties by using e.g. fluorescence approaches, spectroscopy and magnetic resonance techniques in combination with advanced image analyses techniques. We propose that quantitative plant phenotyping will help to better understand gene environment interactions and to assist breeding for enhanced resource use efficiency varieties.

Salinity drives host reaction in *Phaseolus vulgaris* (common bean) to *Macrophomina phaseolina*  
**Ming Pei You, Timothy D. Colmer and Martin J. Barbetti**

984–992

Common bean (*Phaseolus vulgaris*) productivity is often limited by diseases and also by abiotic stress. This study showed that salinity increased severity of the disease caused by *Macrophomina phaseolina* and results in increased tissue Na<sup>+</sup> and Cl<sup>-</sup>, and decreased tissue K<sup>+</sup>. This highlights the importance of maintaining the appropriate balance between K<sup>+</sup> and Na<sup>+</sup> in regions where *M. phaseolina* is a serious pathogen on common bean.

High night temperature decreases leaf photosynthesis and pollen function in sorghum grain  
**P. V. Vara Prasad and Maduraimuthu Djanaguiraman**

993–1003

High temperature stress can limit productivity of grain sorghum. This study is aimed at understanding impacts of high night temperatures in grain sorghum. High night temperature increased the reactive oxygen species content in leaves and pollen grains. High night temperatures decreased leaf photosynthetic rates and pollen viability leading to lower seed yield.

Opposite changes in leaf dark respiration and soluble sugars with drought in two Mediterranean oaks  
**Jesús Rodríguez-Calcerrada, Oula Shahin, María del Carmen del Rey and Serge Rambal**

1004–1015

We studied how leaf respiration was affected by drought in seedlings of two tree species and found that the decline in respiratory rates with drought was not related to a depletion of soluble sugars. Rather, as respiration declines with increasing drought, the pool of soluble sugars that remains available for other metabolic processes can increase.

Groundnut (*Arachis hypogaea*) genotypes tolerant to intermittent drought maintain a high harvest index and have small leaf canopy under stress  
**P. Ratnakumar and V. Vadez**

1016–1023

Groundnut yields were tested across varying water stresses. Root length density, rooting depth and water extraction varied but did not discriminate tolerant from sensitive genotypes. Root length density related poorly to water extraction. Intermittent stress tolerant genotypes maintained a high harvest index under stress and had lower leaf weight. Intermittent drought tolerance in groundnut was related to the development of a smaller leaf canopy.

#### Corrigendum to:

The effect of saline hypoxia on growth and ion uptake in *Suaeda maritima*  
**Anne M. Wetson and Timothy J. Flowers** 1024–1025  
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