Systemic Signalling in Legume Nodulation: Nodule Formation and Its Regulation

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Abstract Legume plants are able to enter into a symbiotic relationship with rhizobia bacteria. This results in the formation of a novel organ on the root called the nodule, where the rhizobia are housed. The rhizobia provide the host plant with nitrogen in exchange for carbohydrates. Successful nodule formation and sustainable nodulation involve complex signalling events. This includes systemic signalling between the symbiotic partners, and also signalling between the root and shoot of the plant. Factors such as plant hormone levels and environmental conditions for growth influence these systemic signalling pathways. This chapter investigates the different types of long-distance signalling events that are necessary for the development and regulation of legume nodulation.

Keywords Auto Regulation of Nodulation (AON) • Shoot Derived Inhibitor (SDI) • CLE peptide • Rhizobia • Flavonoid • Hormone • Acid

1 Introduction

Legume plants are characterised by their ability to enter into a symbiotic relationship with N-fixing bacteria collectively called rhizobia. This partnership requires a complex exchange involving a number of systemic signals. An effective relationship between the two symbionts results in the plant host forming a novel root organ called the nodule (Ferguson et al. 2010; Ferguson 2013). The nodule not only houses the rhizobia and provides them with resource, but also creates a suitable environment for the bacteria to fix atmospheric di-nitrogen into forms of nitrogen that can be used by the plant.

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