

Recommendation by the Cocoa Research Institute of Ghana to Use Pro-Plant in Cocoa Plantations



Foliar Fertilizers Promote Root Exudation and Increase Nutrient Uptake

Foliar fertilizers trigger greater root exudation which contributes to feeding soil microbes leading to increased nutrient uptake.

Foliar fertilization is so important and crucial to good agricultural practices. A plant relocates carbohydrates, including sugars and proteins, to the rhizosphere versus consuming it all for fruit or seed production or overall plant development (above ground).

A number of research reports find that a significant proportion of plant photosynthates are transported below ground shortly after photo-assimilation and subsequently released to soil microbes (Dilkes *et al.*, 2004; Bahn *et al.*, 2009; Mencuccini & Holttä, 2010).

This release can be through direct exudation from the surface of fine roots or by transfer to the extraradical mycelium of mycorrhizal fungi (Jones *et al.*, 2004, 2009; Drigo *et al.*, 2010). Both root exudation and transfer to mycorrhizal fungi occur rapidly after photosynthesis, ranging from a few hours in grasses to a few days in trees (Johnson *et al.*, 2002; Dilkes *et al.*, 2004; Kuzyakov & Gavrichkova, 2010).

Root exudation stimulates microbial decomposition of soil organic matter, which in turn improves nutrient availability along the rhizosphere (Kuzyakov, 2010; Bird *et al.*, 2011; Philippot *et al.*, 2013). Carbon (C) transfer to mycorrhizal fungi benefits the plant through direct nutrient transfer from the fungal hyphal network (Bever *et al.*, 2009; Fellbaum *et al.*, 2011; Kiers *et al.*, 2011). In both cases, the plant's investment in below ground C allocation is rewarded with increased nutrient availability, in particular nitrogen (N) and phosphorus (P) (Hodge & Storer, 2014).

Now we're finding out that this root exudation process not only improves nutrient uptake but also supports the growth of mycorrhizal fungi to help the plant's access to nutrients and water by extending its range into soil areas that are not accessible by roots or into nutrient rich soil "hot spots."

In addition, the extraradical hyphae which enlarge root areas, facilitate the distribution of recently assimilated plant carbon to the soil microbial community. This process, along with the sugar and protein responses through root exudation, may help the plant stimulate specific microbial responses, including enzyme production, to consume the nutrients that the plant needs. Imagine, the plant is communicating with the microbial community, letting it know what it needs at any given time!