ORIGIN SOIL NUTRITION

TECH TALK

GETTING MORE FROM GRASS-CLOVER RESEEDS THIS AUTUMN

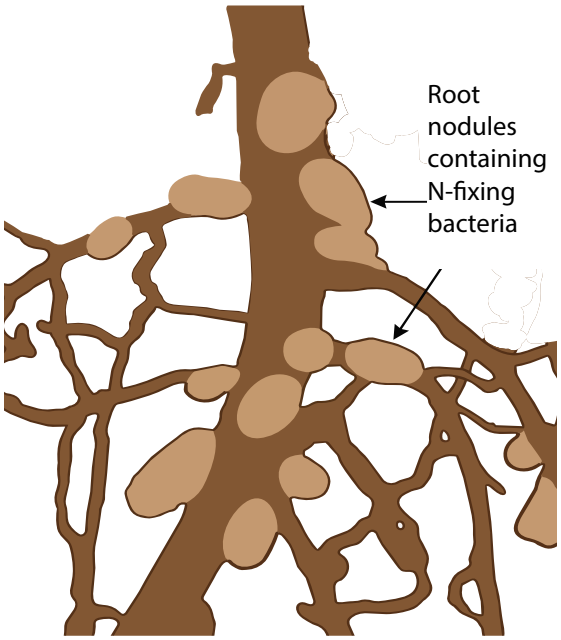
To maximise the ability of clover plants to fix atmospheric nitrogen, we need to ensure they have access to nutrients which support nodule formation and rhizobia bacteria from establishment.

How do clover plants fix nitrogen from the atmosphere?

Clover plants fix nitrogen through a symbiotic relationship with naturally occurring **Rhizobium** bacteria. These bacteria infect the roots of the clover and form **nodules**, where they convert atmospheric nitrogen (N_2) into ammonia (NH_3) using the enzyme **nitrogenase**. The ammonia is then converted into amino acids and proteins that the plant can use for growth.

In return, the clover supplies the bacteria with sugars and energy produced through photosynthesis. This process is highly energy-intensive, requiring large amounts of phosphorus.

Once established, biological nitrogen fixation can supply a significant proportion of the clover's nitrogen requirement, reducing the need for mineral nitrogen fertiliser and benefiting the companion grass through the gradual transfer of nitrogen within the sward.



Roles of key nutrients during grass-clover establishment

Nutrient	Role
Phosphorous	Promotes rapid root development while providing the energy required for early growth. As biological nitrogen fixation is highly energy intensive, an adequate supply of P is essential for successful nodule development and efficient nitrogen fixation.
Calcium	Promotes root tip and root hair development, improving nutrient uptake of young clover plants. Healthy root growth also encourages Rhizobium infection and the formation of effective nitrogen-fixing nodules.
Sulphur	Required for the synthesis of the sulphur-containing amino acids cysteine and methionine, allowing fixed nitrogen to be converted into plant protein. It also improves nitrogen use efficiency and supports vigorous early growth of both grass and clover.
Molybdenum	Component of the nitrogenase enzyme, which converts atmospheric N into plant-available ammonia within the root nodule. It also forms part of nitrate reductase, enabling young plants to utilise soil nitrate efficiently before biological nitrogen fixation is fully established.
Cobalt	Required by Rhizobium bacteria to produce vitamin B12, which is essential for their growth and metabolic activity.

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