

Phosphorus energy for life

Q: What happens to photosynthesis when phosphorus is scarce or runs out?

A: Without phosphorus, photosynthesis won't happen. Most growers know that we need phosphorus to get things moving as plants start to grow. We think of it as an essential nutrient. But it may not be known everywhere that without available phosphorus there is no photosynthesis at all.

Plants capture carbon dioxide from the atmosphere and make carbohydrates, using light as their energy source. When they do this, phosphorus is an essential ingredient. Phosphorus is the element used to make the special energy transport compounds which store light energy, So when phosphorus is scarce, no matter how much sun there might be, the plant simply can't store the energy.

Similarly, when sugar is made by plants during photosynthesis, one piece of phosphorus is used for each unit of carbohydrate that is made. If there is no phosphorus available, plants can't make these sugars. Unfortunately for plants growing in Australia, most of our soils have a strong attraction for phosphorus and most of what is added as nutrient is very quickly bound to soil particles as a result. When this happens, plants no longer have access to the phosphorus. So even after applying large amounts of phosphorus to the soil, plants can be starved for available phosphorus.

Even when times are good, plants don't make enough energy transport compounds to store the energy they need for growth. About 20% of the energy transport compounds plants need have to come "readymade" and "pre-fitted" with phosphorus from the soil, Plants rely on this supply of energised phosphorus compounds to complete their own photosynthesis. When it doesn't happen, they don't grow well.

The good news is that healthy soil contains microbes which also photosynthesise. Where plants are unable to use phosphorus once it is bound to the soil particles, there are special microbes whose job it is to release the phosphorus and make it available in a soluble form. There is a fascinating community effort which goes on below ground when soil is healthy which keeps phosphorus "in play" in a pool of phosphorus which plants and other microbes can use. Depending on the way in which soil is looked after, the community of organisms which keep phosphorus available either increases or diminishes. In most farmed soils these organisms are now much lower in population than they once were.

Keeping soil biology healthy is an integral part of making phosphorus available for plant growth. Plants can't source enough phosphorus or enough energy on their own. They need the community effort below the soil to manage both the supply of phosphorus needed to make sugars and the supply of the energy transport compounds (which contain phosphorus) needed to capture light energy. Soil communities including photosynthetic bacteria recycle phosphorus continually. These microbes outsource the manufacture of energised phosphorus compounds for plants. When they are happy, we need to add less phosphorus. When they aren't working, everything stops.