**Harnessing Satellite Technology to Improve the Sustainability of Walnut Orchards**

Walnuts are one of the most nutritionally dense foods on the planet. They are packed full of protein, healthy fats, fibre, vitamins and minerals. Walnuts have also been shown to have a higher antioxidant activity than any other common nut.

Given their high nutritional value, walnuts could play a large role in combatting malnutrition and achieving global food security. They are also a climate-friendly choice, as walnut trees sequester carbon dioxide from the atmosphere as they grow.

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However, in non-organic walnut orchards, chemical fertilisers containing nitrogen, potassium and calcium are typically applied, to improve tree health and boost nut yields. When excessive amounts of these chemicals are applied, they can leach into the surrounding environment, damaging local ecosystems. In addition, unbalanced ratios of nitrogen, potassium and calcium can even reduce the quality of the nuts.

To ensure that correct amounts of each nutrient are applied to walnut orchards, leaf samples are often analysed before fertilisers are applied. Acquiring and analysing enough leaf samples is very time consuming and expensive, and only provides average nutrient levels across a whole orchard.

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Now, Portuguese researchers Dr Ana Elisa Rato, Dr Adélia Sousa and their colleagues at MED Institute in the University of Évora have developed an inexpensive, rapid approach to assess nutrient levels in walnut orchards, by harnessing the power of satellite technology.

When developing their method, the researchers acquired satellite images of a walnut orchard in Portugal. The images were captured by infrared and visible-light cameras on board the European Space Agency’s Sentinel-2 satellite.

To calibrate the method, the researchers analysed leaf samples from the orchard, to measure the concentrations of nitrogen, potassium and calcium. They took these measurements using a technique called near-infrared spectroscopy, which they had previously optimised for analysing leaf samples as part of a project called QUALFASTNUT.

Using all the available data from the Sentinel-2 satellite optical bands, and applying a supervised machine learning approach, Dr Elisa Rato and Dr Adélia Sousa built predictive models that can accurately estimate levels of each nutrient using satellite imagery alone.

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Using this new approach, the research team can generate a detailed map of a walnut orchard, which shows the distributions of these key nutrients throughout the entire orchard.

Armed with this knowledge, farmers will be able to apply the minimum amount of fertiliser required to maintain the health of their trees. Not only will this method improve the quality and yields of their crops, but it will also prevent excessive applications of these chemicals, reducing pollution and environmental damage.

The team’s new approach could also be adapted for different types of fruit and nut orchards, including apples, pears, almonds, cashews, cherries and citrus fruits.

**////bio slide:**

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