Using fire extinguisher powder to grow leafy vegetables. Myths and realities.

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Introduction

Phosphorus is an essential element for plant growth and is often used in fertilizers to promote root development and overall plant vigor (Sposito 2008).

At the same time, phosphorus-based dry chemical powder is used in fire extinguishers to smother fires and promote safety. The type of phosphorus used in fire extinguishers is typically monoammonium phosphate (MAP) or diammonium phosphate (DAP) which is also a common component in fertilizers.

Figure 1: Fire extinguishers with phosphorus-based dry chemical powder.

In fact, DAP is a dry chemical powder that is commonly used as a fertilizer and a fire suppressant. This common use of phosphorus in both fire extinguishers and fertilizers highlights the versatility of this element and its importance for both safety and agriculture.

The quantity of extinguisher powder waste is exponentially increasing every year, given the rapid increase in the use of dry fire extinguishers (Lobos 1965) world-wide and the requirement for regular maintenance and powder replacement due to expiration.

Both problems with the treatment and storage of the powder most often arise. To address the problem of powder waste disposal, several treatment and recycling procedures have been proposed including its use in bituminous mixes (Pratico et al. 2009) or as a fertilizer in agriculture (Soja et al. 2021).

Particularly the treatment and use of powder wastes as agricultural fertilizers, not only serves the goal of sustainable farming but can also prove a potentially cheaper source of phosphorus.

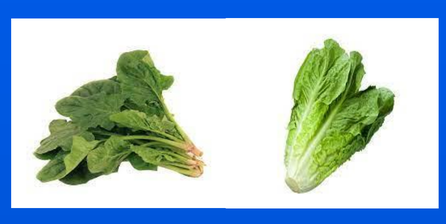

Figure 2: Spinacia oleraceae and the lettuce Lactuca sativa.

The crisis of 2022, where the price of DAP raised more than 85% showed that it is required to have alternative sources of phosphorus to the usual production method for mining rock phosphate. In this work we investigate optimal powder waste treatment and usage techniques in agriculture.

Results & Discussion

The figures show the results obtained after measuring the physicochemical characteristics of the metals (Figure 1) and the phosphorus content on the stems of the two plants (Figure 2).

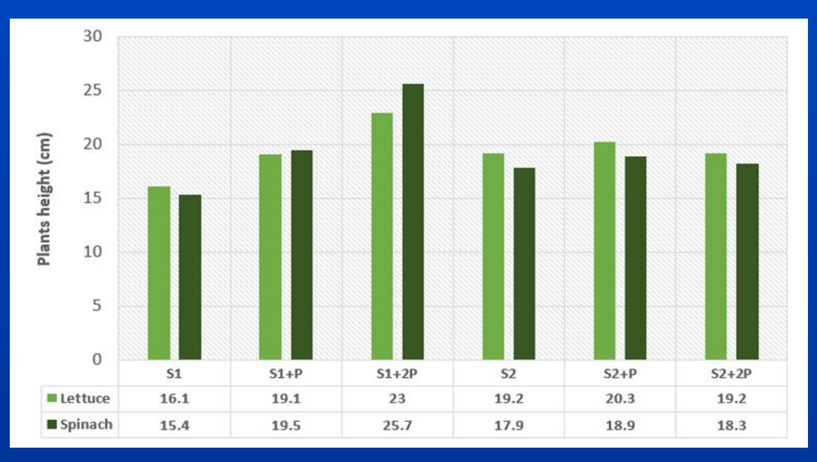

Figure 1. Variation in plant heights after the application of two different powder levels to the soil samples.

Regarding the height variation (Figure 1) both lettuce and spinach seem to change in proportion to the addition of the dust in the experiment conducted on soil sample 1. In contrast, the uptake of phosphorus by the plant stems (Figure 2) does not seem to vary or depend on the physicochemical properties of soil samples 1 and 2.

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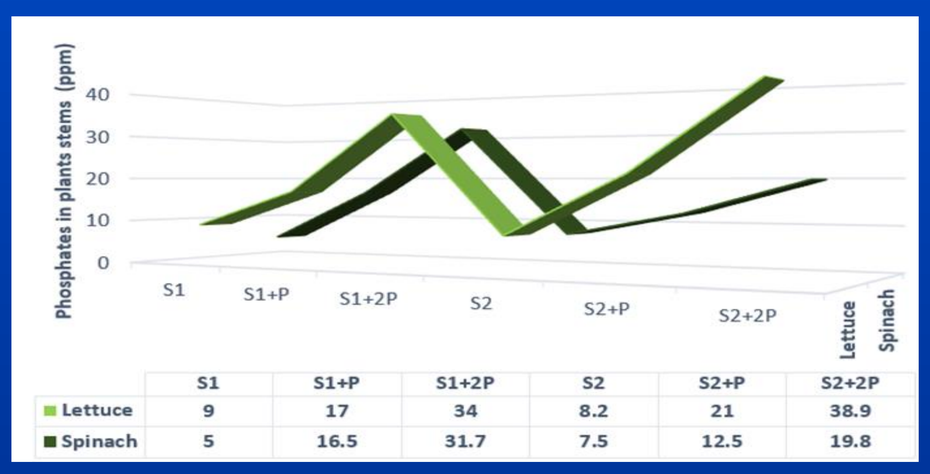

Figure 2. Variation in phosphates concentration in plant stems after the application of two different powder levels to the soil samples.

The preliminary experiment gave significantly promising results as it showed that the powder used released the phosphorus it contains, and it was taken up by the plants.
Further study is considered necessary in determining the optimum ways and techniques of nutrient release from the powder and the soil parameters that determine their uptake by leafy vegetables.

Conclusions

Fire extinguisher dust may be a promising tool that can increase crop productivity. It is an environmentally friendly and low-cost method, which does not seem to cause any problems with the crops' physiology and the soil's functionality, supporting the principles of the circular economy..

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