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

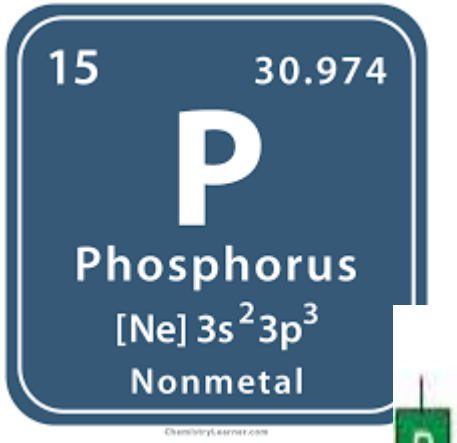
E.E. Golia[1], G. Benardos[2], I. Tsigka[1], N. Kiatikidis[1], V. Diakoloukas[3]

[1] Aristotle University of Thessaloniki, email: egolia@auth.gr

[2]AiGROW Effective Agriculture S.M.P.C, Averof 34, Nea Ionia Attica, 142 32, Greece, email: gbenardos@aigrow.gr

[3]Technical University of Crete, email: vdiakoloukas@tuc.gr

Introduction



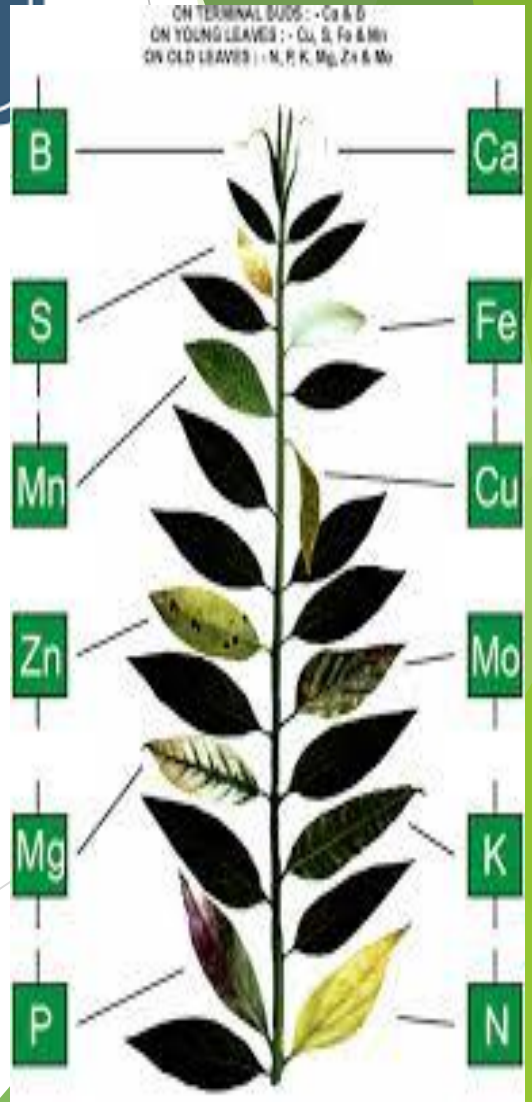
Phosphorus: an essential element for plant growth, often used in fertilizers to promote root development and overall plant vigor.

Phosphorus-based dry chemical powder is used in fire extinguishers to smother fires and promote safety.

monoammonium phosphate (MAP) diammonium phosphate (DAP)

DAP: dry chemical powder, commonly used as a fertilizer and a fire suppressant.

This common use of phosphorus highlights the versatility of this element and its importance for both safety and agriculture.



Introduction

The quantity of extinguisher powder waste ↗ per year

- rapid increase in the use of dry fire extinguishers world-wide
- requirement for regular maintenance and powder replacement due to expiration.

Problem of powder waste disposal ⟶ several treatment and recycling procedures e.g. in bituminous mixes or as a fertilizer in agriculture.

As agricultural fertilizers, not only serves the goal of sustainable farming but can also prove a potentially cheaper source of phosphorus.

In 2022, where the price of DAP ↗ >85% showed that it is required to have alternative sources of phosphorus.

Materials and methods

Purpose: optimal powder waste treatment and usage techniques in agriculture.

- Pot experiment
- Two composite soil samples x3 replicates (physically mixing, individual six subsamples of a 1m radius area by bucket auger)
- 3.5 kg of soil 1 and 4 kg of soil 2 / per pot
- Complete randomized block design
- (2 levels of the dust + control) x3

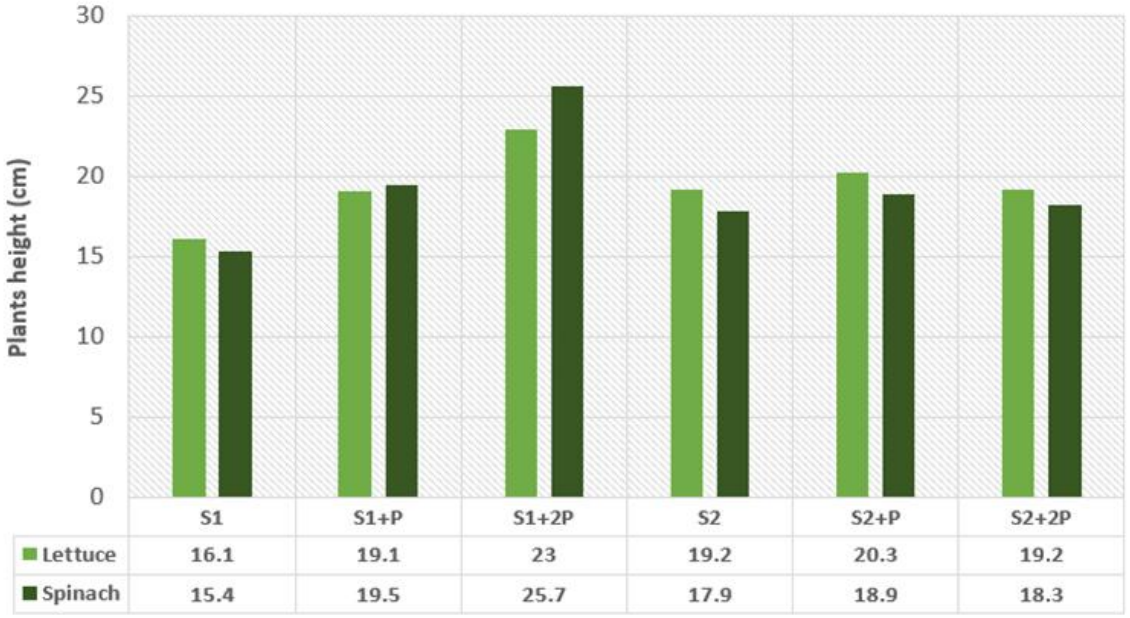
The moisture content of each pot was maintained at 70% by weighing the pots twice a week to compensate for evapotranspiration losses.

Harvest: after 53 for the spinach *(Spinacia oleraceae)* and after 45 days for the lettuce *(Lactuca sativa)*.

Origin of the powder: a local fire extinguisher filling factory.

Preliminary experiments: to mix the powder with substances that limit the waterproofing of the powder granules, in order to increase the availability of available ingredients.

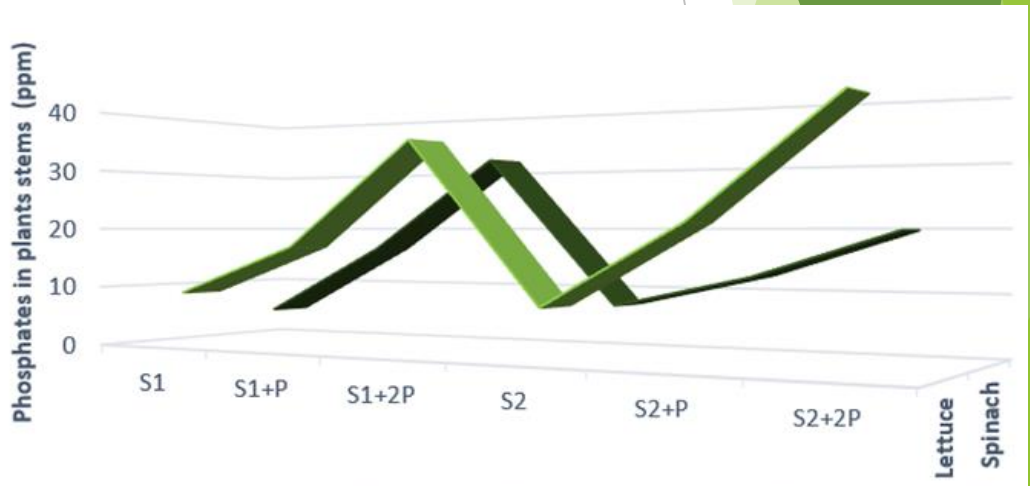
Results



	S1	S1+P	S1+2P	S2	S2+P	S2+2P
Lettuce	16.1	19.1	23	19.2	20.3	19.2
Spinach	15.4	19.5	25.7	17.9	18.9	18.3

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.



	S1	S1+P	S1+2P	S2	S2+P	S2+2P
Lettuce	9	17	34	8.2	21	38.9
Spinach	5	16.5	31.7	7.5	12.5	19.8

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.

Future work

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.

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