Summary Research Report conducted by Wifrid Laurier University Utilizing Spanish River Carbonatite

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Introduction:

This report displays the main findings of experiments testing the effects of the agromineral Spanish River Carbonatite (SRC) on field pea (*Pisum sativum*) performed in the growth room facilities at Wilfrid Laurier University. Different SRC concentrations were tested on soil pH, soil microbes, and plant growth/yield.

Growth conditions:

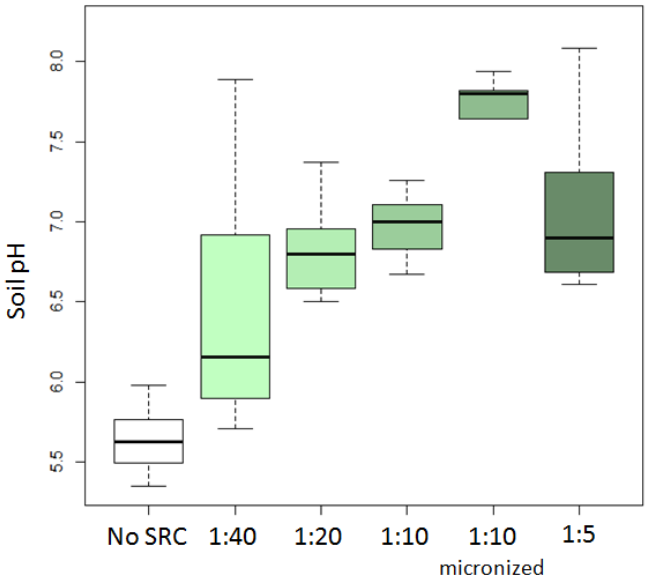
Plants were grown in a 1:1 mix of vermiculite:turface® to prevent introduction of organic matter. Plants with no SRC were given a full macro and micro nutrient fertilizer solution. **Note** that it was necessary to add a nitrogen solution to SRC plants to remove N-deficiency symptoms. Compositions of both solutions used are given in the table on the right. For yield experiments, the nutrient solution was also supplemented with an N:P:K (24:8:16) fertilizer given at 2g/L for plants receiving no SRC.

Nutrient solution

Nutrient	mg/L
N	820.44
P	272.17
K	972.94
Ca	410.22
Mg	246.47
S	597.15
Fe	69.01
B	1.55
Zn	0.58
Mn	0.34
Cu	0.12
Na	2.42
Mo	0.12

Nitrogen solution

N	820.44

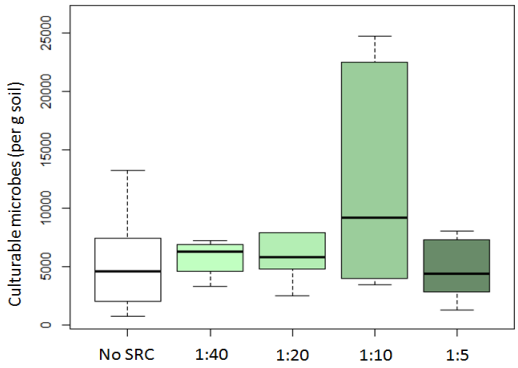


Results:

In the figures below, the amount of SRC used in a treatment is given as a ratio (SRC:soil). The darkness of colour in the boxplots is indicative of SRC concentration; as the colour darkens the SRC concentration increases (from left to right). The solid black line indicates the median value of that measurement, while the coloured box around it displays the variability in the data. The dotted lines indicate maximum and minimum values.

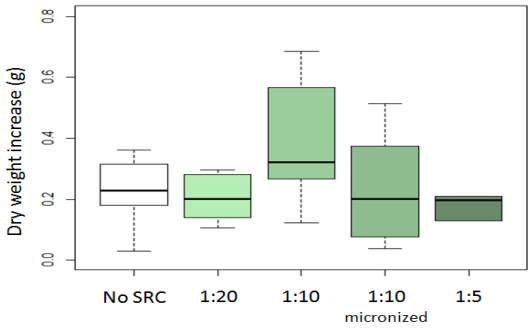
SRC has a liming and buffering effect on soils

- As the amount of SRC in the soil is increased, the soil pH increases as well to approximately pH 7.0 (see figure left).
- Soils with SRC maintain their pH over the entire growth period (42 days) while soils to which only chemical fertilizers are added become more acidic (by 0.5 pH units).



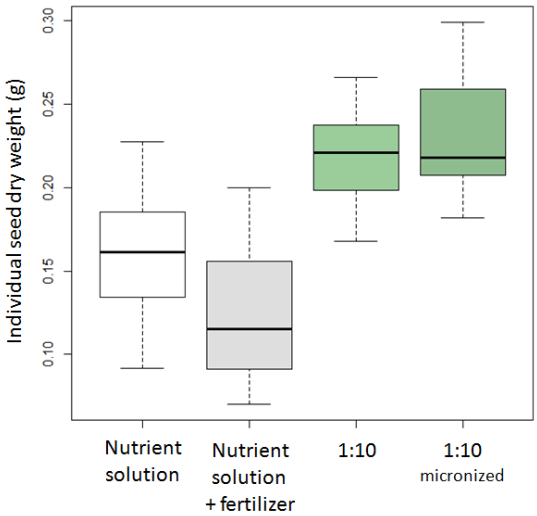
SRC promotes growth of soil microbes:

- At the recommended SRC ratio (1:10), the number of microbe colonies per gram of soil is over twice that of soil with no added SRC (see figure left).
- Plant samples collected from the SRC deposit are colonized by mycorrhizal fungi, suggesting no negative effects of high SRC concentrations on these beneficial root symbionts.



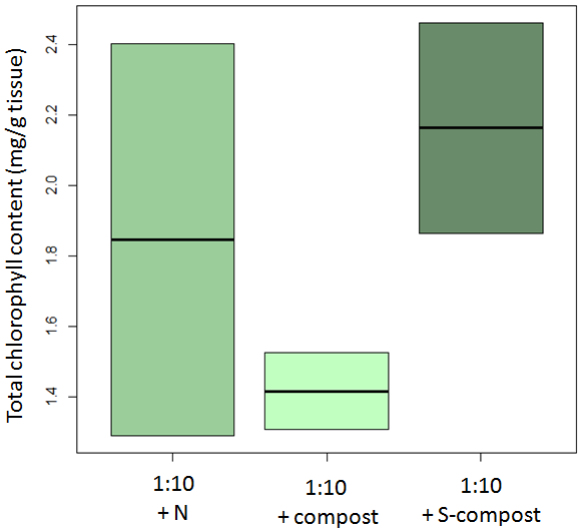
SRC slightly increases plant growth:

- With even small amounts of SRC and supplemental nitrogen, plant growth is similar to that of plants given chemical fertilizer but no SRC (see figure left).



SRC increases seed size:

- When grown to maturation, plants given a 1:10 ratio of SRC:soil produce seeds with greater dry weights than those given nutrient solution, even when that solution is supplemented with additional N:P:K fertilizer.
- However, slightly fewer seeds are produced (~25%) by plants given SRC.



<u>SRC + compost provides full nutrients</u>:

- Total chlorophyll content is an indirect measure of plant N status.

- Combined use of SRC (1:10 ratio) and compost made with SRC (S-compost) provides plants with higher N than a chemical N solution.

- Compost made without SRC appears to be a poor source of nitrogen when combined with SRC in the 1:10 ratio.

Summary:

- At the recommended concentration (1:10), the addition of SRC increases the ability of soils to maintain optimal soil pH and a well populated microbial community as well as providing tangible benefits to crop plants in terms of growth and yield.

- This suggests that a combination of SRC and S-compost (and likely mycorrhizal fungi) is a viable alternative to chemical fertilizer use for crop plants. High SRC concentrations do not appear to negatively affect mycorrhizal fungi; this is of benefit because these fungi can improve plant nitrogen and phosphorus nutrition.

- Micronized SRC provides no additional benefits to plant growth beyond that of the 1:10 concentration of SRC, and in some cases may have negative effects (e.g. high soil pH).

- The increased seed size seen with SRC treatment would result in increased plant size, as the dry weight of plants were strongly affected by starting seed.

- Continued research is focusing on removing the need for chemical N by supplementing the soil with S-compost and mycorrhizal fungi, as well as further on analysing the nutrient content and yield of SRC-treated plants.