

THE EFFECT OF CLAY ON THE INHIBITORY EFFECT OF MUSTARD SEED MEAL ON VELVETLEAF SEEDLING GROWTH

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Abstract

Mustard seed meal (MSM) has been studied as a biofumigant that suppresses weed growth organically. Previous studies have shown that MSM in soil with a higher sand content was highly effective in suppressing the germination of weeds, and that as clay/silt in sand content increased, MSM effectiveness decreased in suppressing seed germination. Based on these results, it was postulated that clay may have effects on MSM by inhibiting it from suppressing weed growth. Two different types of pure clay--kaolin and montmorillonite--were selected to test at various concentrations. Low concentration of clay in MSM does not seem to have effect on inhibiting the weed suppressive properties of MSM.

Background

Mustard Seed Meal (MSM) is a natural herbicide which acts as a biofumigant inhibiting weed and fungal pathogen growth. One of the products from hydrolysis of glucosinolates is isothiocyanate (ITC), which is a very effective herbicide (Bones & Rossiter, 1996).

Several conditions affect MSM by either maximizing or diminishing its effects. One of these factors is soil texture (Price et al. 2005). Sand was the most effective in promoting MSM action. On the other hand, as clay and silt concentrations increased, MSM efficacy reduced, resulting in less seedling growth. It is possible that clay alone can reduce MSM efficacy in soil.

It was first hypothesized by Harning (2020) that air pockets in sand may allow the volatile ITC MSM to diffuse throughout the soil resulting in suppressed seed germination, and that reducing these air spaces by increasing the amount of clay/silt present interferes with the diffusion of the volatile ITC from MSM. Therefore this study examines the potential of pure clay to reduce MSM efficacy in suppressing velvetleaf seed germination and growth in sand-clay mixtures.

Methodology

In order to test the effects of the clay (particles less than 0.002 mm in diameter) on MSM inhibition on seed germination, two types of pure clay were selected: kaolin and montmorillonite. The methodology was based on the previous studies done by Harning et al. (2020).

- For each type of clay, four different sets of soil mixture were tested with increasing concentrations of clay in sand content, starting from 0%, 0.01%, 0.1% and 1% clay in sand.
- Clay and sand mixtures with (-) and without (+) MSM from *Brassica juncea* Pacific Gold (1g in each 100g of sand mixture) were prepared in a plate germination assay prepared in duplicate. 22 mL of water was added to each assay plate.
- 24 velvetleaf seeds were disinfested and randomly planted in each plate. The sealed plates were incubated at 29 °C for 48 hrs. After 48 hrs of incubation, the germinated seed radicles were counted and radicle length measured in mm.
- The average length of the germinated seed radicles and the percent of germination were calculated.

Results

The 0%, 0.01%, 0.1% and 1% of clay did not affect the effectiveness of MSM. All the seedlings failed to germinate despite the presence of MSM.

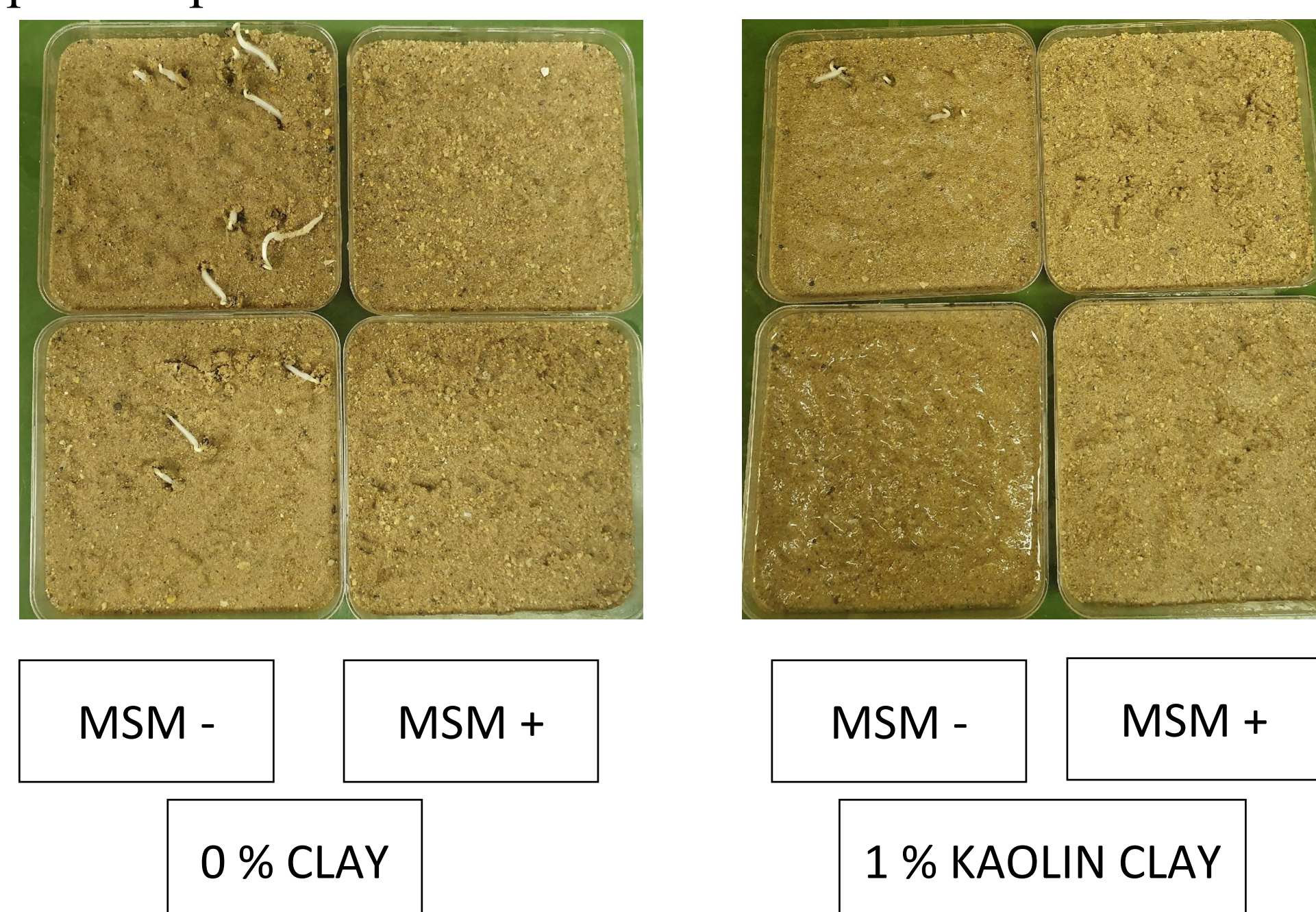


Figure 1. Plate Germination Assay. There was seed germination on absence of MSM at 0% of clay.

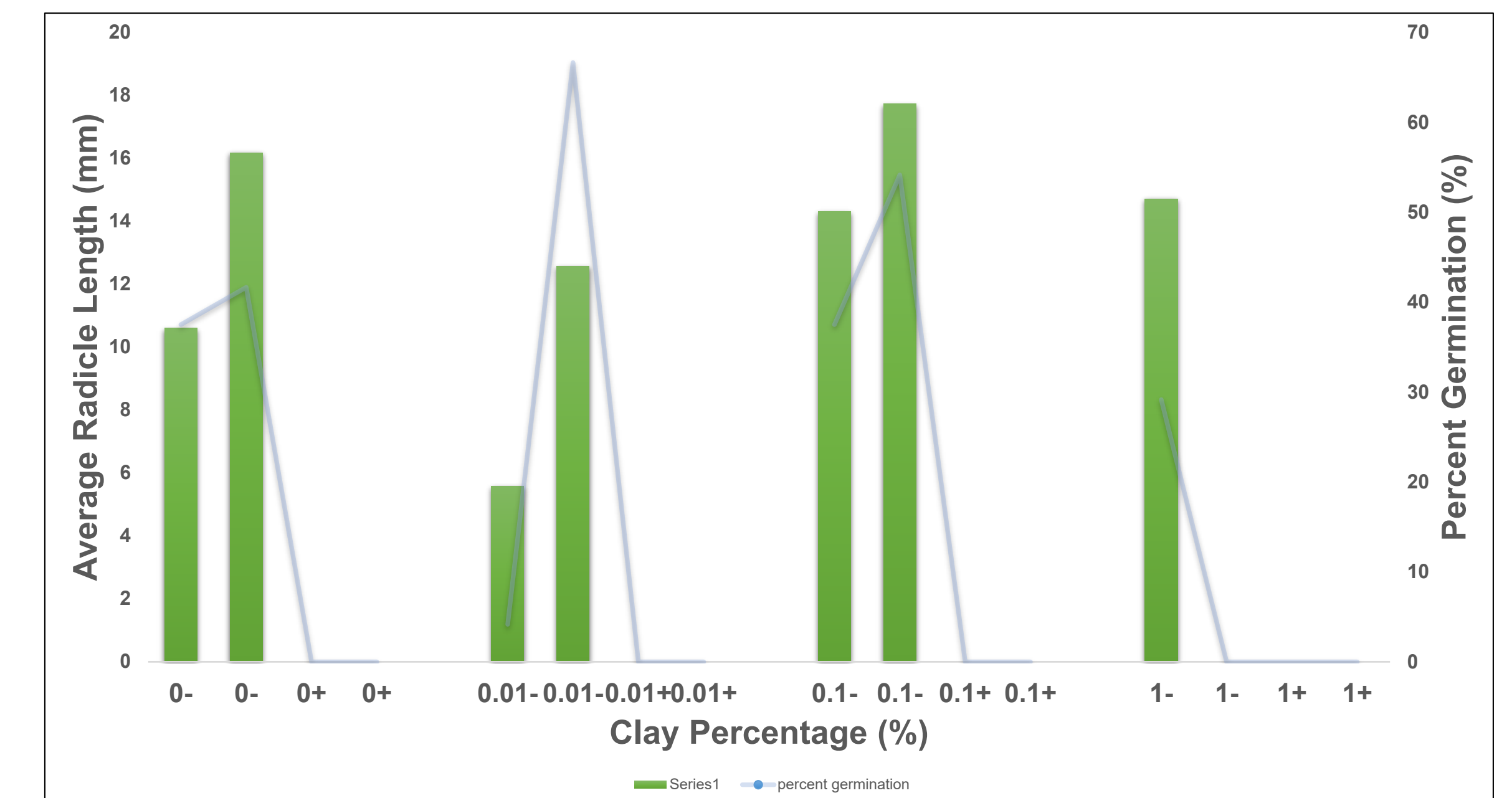


Figure 2. Velvetleaf seed germination in sand with different percentages of kaolin clay and in the presence (+) and absence (-) of mustard seed meal. In the presence of MSM, all the seedling growth was suppressed.

Conclusions

- The experiment is still ongoing, and due to insufficient results and trials, analysis of the results is inconclusive.
- Low concentrations of clay (0~1%) do not seem to have effect on MSM effectiveness.
- Another clay type, montmorillonite, needs to be tested, and some adjustments for higher concentrations of clay are needed to be done for further step.

Literature Cited

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