

Summary of Field Trial at Lethbridge College

Evaluation of 5 organic soil amendments for germination of barley and pea in greenhouse experiment

Report prepared by Dr. Nick Savidov

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Objectives of the Study

The main objective of the study is to evaluate the effect of organic soil amendment formulations on germination and growth characteristics of barley and pea.

Background

Plant nutrition is one of the central points of any farming practice including organic farming. Although organic agriculture is based on sources of plant nutrients other than mineral fertilizers, the fact that the growth of agricultural crops is dependent on level of mineral nutrients dictates necessity of extensive research on nutrient value of different organic fertilizers. Most nitrogen in organic fertilizers is in the form of organic nitrogen, which is not available for plants. In order to be consumed by plants it has to be transformed through processes called ammonification and nitrification. Therefore, organic fertilizers can be considered as N-slow-release fertilizers.

One of the important benefits of organic fertilizers is stimulating soil biological activity, which can positively affect young plant seedlings in many aspects including germination and enhanced plant nutrition contributing to more vigorous plant growth. The early positive effect of the organic fertilizers on seeds and plants will contribute to the better final yields of the crops.

Biochar is a material produced from various feedstocks including straw, sawdust, coir using pyrolysis at 500-600°C. It has many characteristics, which make it beneficial for soil applications including high air porosity and water retention capacity, extremely high stability in soil and buffering capacity. Biochar can also provide housing for beneficial soil microflora, which improves overall soil biological activity. These benefits make biochar a valuable component of various organic fertilizer formulations for organic farming.

Materials and Methods

Two crops used in the germination tests included peas, *Pisum sativum*, and barley, *Hordeum vulgare*. Peat moss was chosen as the growth medium in the experiments. The crops were planted in 2 L pots (16.5 cm diameter × 13 cm high). Six replicates were used for a robust statistical analysis. The leachate from each pot was collected separately. The experiment consisted of six treatments listed as following:

- ✓ Control Group - Soil with no added fertilizer
- ✓ GrowER
- ✓ GrowER Biochar 4%
- ✓ GrowER Frass 25%
- ✓ GrowER Frass 50%
- ✓ GrowER Frass 80%

Forty grams of each fertilizer was measured, mixed with two liters of peat moss and added to each pot. Water was added to each pot to reach 100% of maximum Field Capacity, FC (until drainage occurred at the bottom of the pot). After planting seeds, water was provided to each pot to have 60% of FC. Five seeds were planted per pot, at a depth of 1-2 cm. The plants were observed every day, counting germinated seeds, measuring the length of the shoots and counting the number of leaves.

The experiments were repeated several times. First set of seeds was planted on May 29, 2020. The pots were then covered with a layer of plastic film to prevent excessive evaporation. Following that, a second set of seeds was planted. Second set was planted on June 17, 2020. Seeds were planted at a depth of 1 cm and the pot left uncovered. The third set of *P. sativum* plants was planted on June 29, 2020. Measuring commenced from June 30, 2020. Seeds were planted at a depth of 1 cm and the pot left uncovered.

Materials and Methods Continued

The second day after planting germination rates were improved compared to the previous set, with 2 plants sprouting in each pot on average on the first day after planting. Additional *P. sativum* seedlings were observed sprouting in the following days, with the final germination percentage reaching 89.44% on the seventh day after planting.

The following germination and growth parameters were evaluated during observations:

- ✓ Germination Index (GI)
- ✓ Germination Rate Index (GRI)
- ✓ Vigor Index (VI)
- ✓ Final Germination Percentage (TG)
- ✓ Plant Fresh and Dry Weight
- ✓ Plant Leaf Count
- ✓ Plant Stem Length

Results

A series of the experiments was conducted to study the effect of various organic fertilizer formulations on germination characteristics and growth of two crops, barley and pea. The treatments included Frass 25%, Frass 50%, Frass 80%, ER 100% and Biochar 4% + control. The germination parameters included Final Germination Percentage, FGP, Germination Rate Index, GRI, Germination Index, GI, and Vigour Index, VI. The growth characteristics included shoot height, leaf count, fresh and dry biomass.

There was a positive effect of all used formulations of seed germination characteristics compared to control during the 1st week of germination. Two crops responded differently to the fertilizers during growth and development with Frass formulations best for barley and 100% ER and 4% Biochar best for pea.

GRI and VI were the best parameters to verify the effect of the fertilizer formulations on seed germination.

The study indicates a potential benefit of the developed organic fertilizer formulations for organic farms in Alberta.

Figure 1: The graphs above show the daily average growth curve for both barley (left) and peas (right).

