Does the volume, and chemical composition of frass affect the yield and growth rate of certain crops?

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Overview

As the world's population increases, the demand for food also increases. This has put strain on farmers and their land. Soils used for arable farming need to be enriched in order for successful crop growth, however traditional fertilisers have become too expensive and are having a detrimental effect on local ecology. This project is going to use potting trials to determine if frass (a by-product of insect driven decomposition) and chitin are effective alternatives.

Figure 1. The source of frass, the excrement and shed exoskeleton of the black soldier fly

Aims

1. To determine the effect of frass and/or chitin on the rate of growth of sweetcorn
2. To determine the effect of frass and/or chitin on the protein content of the sweetcorn plant
3. To determine the effect of frass and/or chitin on moisture retention and pH of soil

Background Information

It is estimated that 20-25% of global carbon dioxide emissions are from arable farming. The ploughing of land releases carbon into the atmosphere, however as the demand for food increases, the lands are being ploughed more, to maintain good soil health.
Frass, a by-product of insect farming, particularly black soldier flies has been found to be a promising alternative. Indeed, previous research by the school and Durham University has demonstrated that growth rates of sweetcorn plants are comparable to, if not better than commercial grade fertiliser (Figure 2). Phytohormone analysis showed an increase in abscisic acid in these plants, a hormone that is released during the stress response, facilitating growth. (Figure 3).

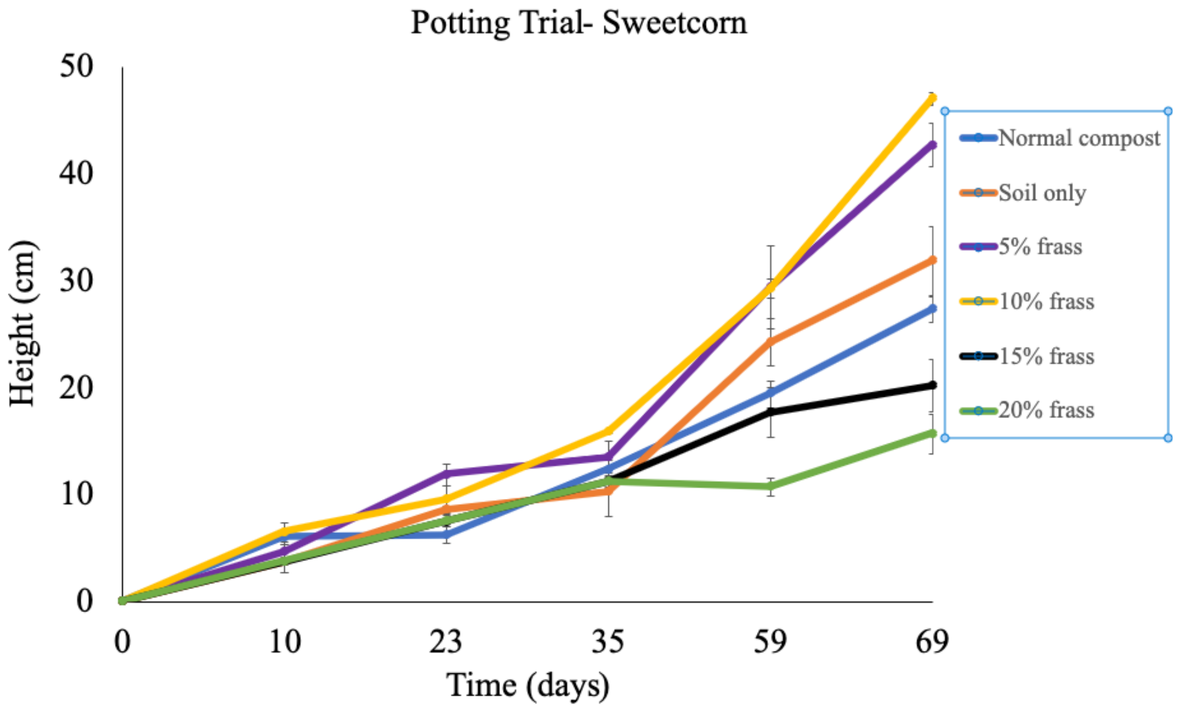

Figure 2. Graph showing the height of sweetcorn plants grown with different levels of frass over 69 days

It is hypothesized that this may be due to the chitin found in the exoskeleton of the flies. This project will now determine if frass and commercial chitin can be used synergistically to increase growth rate and yield of sweetcorn plants.

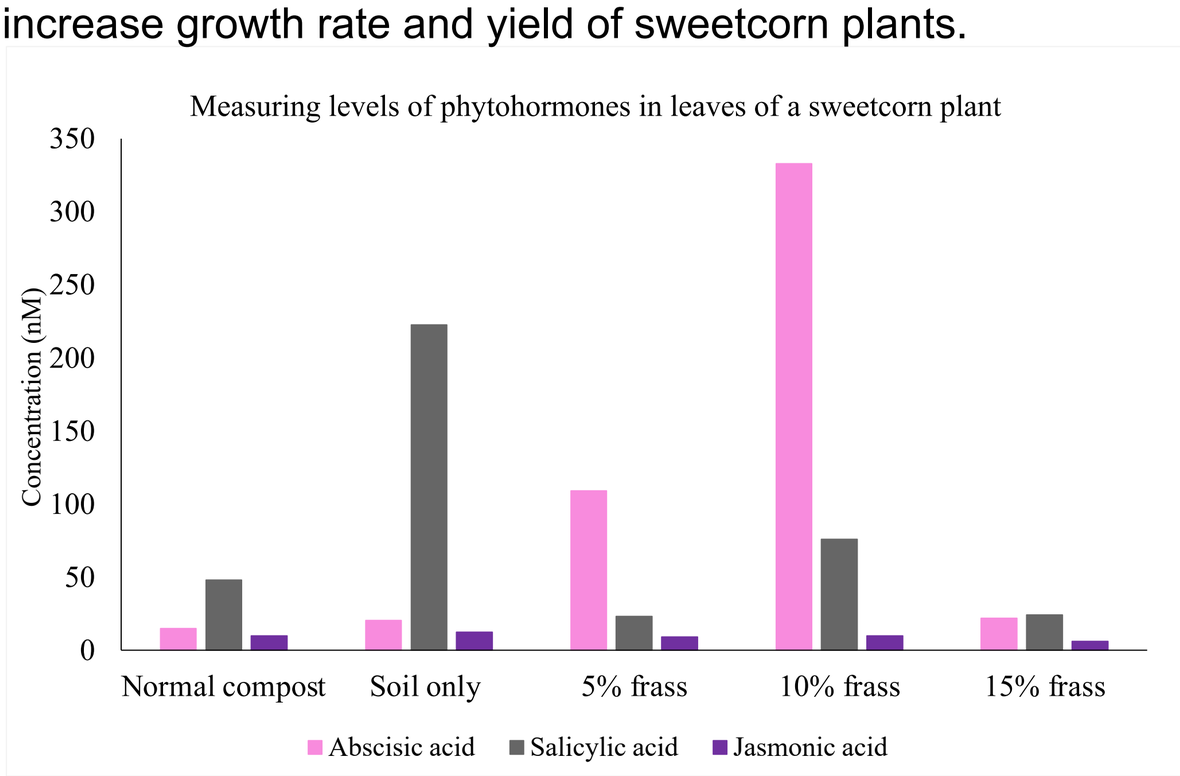

Figure 3. Graph showing the levels of different phytohormones in sweetcorn plants after 69 days

Methodology

<u>Potting Trial</u>

1. Soil will be dried out to ensure that mass of soil can be controlled for. Frass, chitin or a combination of frass and chitin will be added to non-enriched soil. Non-enriched soil and commercial grade enriched soils will be used as controls.
2. Five seeds will be planted per pot. The number of seeds that germinate will be recorded and the strongest seedling will be maintained and any others removed.
3. Plants will be watered once a week with a fixed volume of water and will be placed in a green house with similar light intensity.
4. Measurements that will be taken weekly include; length of the main stem, circumference of main stem, pH of soil, moisture content of soil and intensity of colour of the plant
5. Measurements that will be taken at the time of harvest include; mass of plant above soil (wet and dry), mass of roots (wet and dry), length of root and protein content of the plant.

Predicted Results

Sweetcorn plants that are grown in frass and chitin separately will have an increased growth rate and yield compared to commercial grade fertilizer. The growth rate and yield will be even bigger when chitin and frass are used together. Sweetcorn plants in frass and/or chitin will have a more intense green colour due to an increase in photosynthesis.

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