Grassification

D2.1.1
Assessment report of using the liquid fraction of grass as fertilizer

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1. Introduction

1.1 General background

Roadside grass clippings are a problem fraction throughout the 2 Seas Programme area due to their high volume, subject to high processing costs. Both industry and local authorities, however, are interested in the possibility of using roadside grass clippings as a novel bio-based resource.

The overall objective of the Grassification project is to apply a multi-dimensional approach to roadside grass clippings refining in order to optimize it into a viable value chain for the bio-based and circular economy. The project commits itself to optimize logistics and technical aspects of the grass clippings supply chain and processing, demonstrate its market potential as well as formulate policy and legal recommendations to create a more supportive framework for the recycling of this renewable resource. These actions will increase the volume of usable material, lower costs, and generate a higher added-value for this so called 'waste' streams, which eventually will result in a higher market value of the industry. In this way, the use of roadside grass clippings as a renewable resource for the production of bio-based products and hence the circular economy will become more attractive. Roadside grass clippings refining thus facilitates transition towards a circular economy.

One of the main value-chains currently investigated for grass, also contemplated in the Grassification project, is the production of materials from the fiber fraction, such as building materials, insulation panels, biocomposites, and others. This may entail a first fractionation step, where the solid and liquid fractions are separated. The obtained liquid fraction can account up to 60% of the total fresh weight of the initial biomass; therefore, its valorisation is important for developing an economically viable value-chain from grass. In the Grassification project, the characterization of the liquid fraction was carried out and three main value-chains were investigated for valorizing the liquid fraction of grass:

- recycling minerals in the liquid fraction for organic mineral fertiliser production
- production of energy through anaerobic digestion
- production of insects and microalgae with the liquid fraction as nutrient source

This report describes the results of recycling minerals in the liquid fraction for organic mineral fertiliser production. The research was carried out by Canterbury Christ Church University with the assistance of Ghent University.

1.2 Goal of this study

The goal of this study was to determine the feasibility of using the liquid fraction of pressed grass from roadside verges as a fertilizer. Even though the volume of grass clippings generated yearly is quite relevant and incurs in high processing costs, the volume of liquid fraction that could be produced yearly in Belgium would cover less than 0.2% of the nitrogen utilization in agricultural land in the country. Therefore, the Grassification project aimed at evaluating horticulture products, as these use a much lower volume of fertilizers, but are still an important market in the 2 Seas area. Based on initial characterizations of the N, P and K content of the liquid fraction, tomatoes where chosen for the experiments as the nutrient proportions in the liquid fraction are similar to the ones found in commercial tomato feeds.

2. Liquid fraction of grass as a tomato feed

To assess the potential of using the nutrients of the liquid fraction of grass as fertilizer, this new product was compared to two commercially available tomato feeds, one inorganic and one organic (plant based). A fourth treatment using water, without any nutrient addition, was also carried out as a control.

The liquid fraction of grass overall had the opposite effect as intended. From 10 plants initially grown for each of the conditions tested, only 4 survived the liquid fraction treatment, and these were not healthy by the end of the experiment. Two weeks after the first feeding with the liquid fraction, the plants leaves were significantly more yellow that the other treatments (Figure 1).

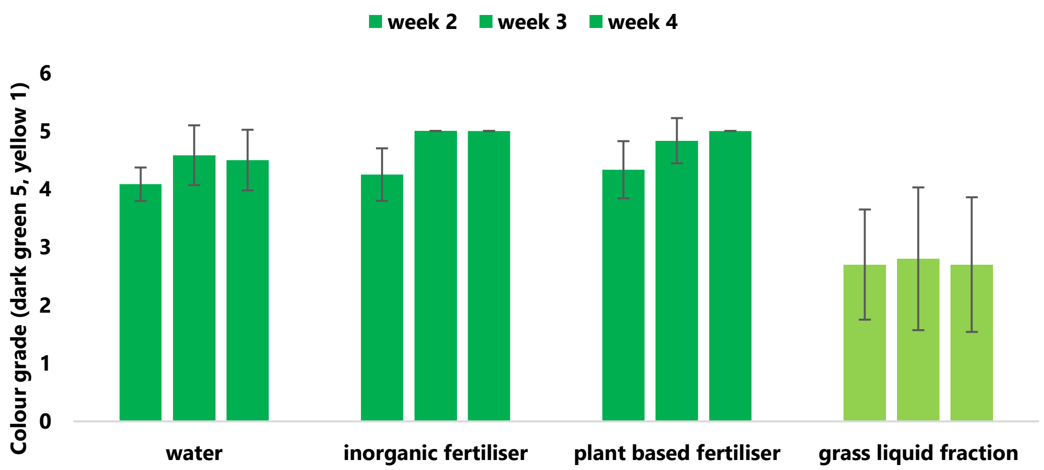

Figure 1: *Colour grading of plant leaves after 2, 3 and 4 weeks of different treatments*

Leaf samples were taken for nutrient analyses and the plants fed with the liquid fraction showed significant deficiency for N, P and K (Figure 2).

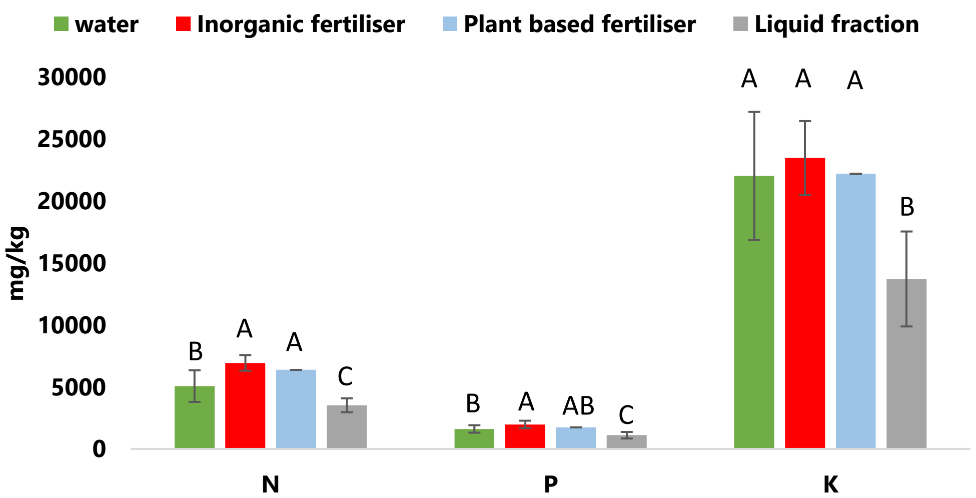

Figure 2: *Nutrient content of plant leaves after 2 weeks of different treatments. Different letters indicate statistically significant difference between the parameters*

Even though the plants fed with the liquid fraction where not healthy, tomato production was observed for all treatments; however, as expected, the liquid fraction treatment yielded less tomatoes than the others (Figure 3).

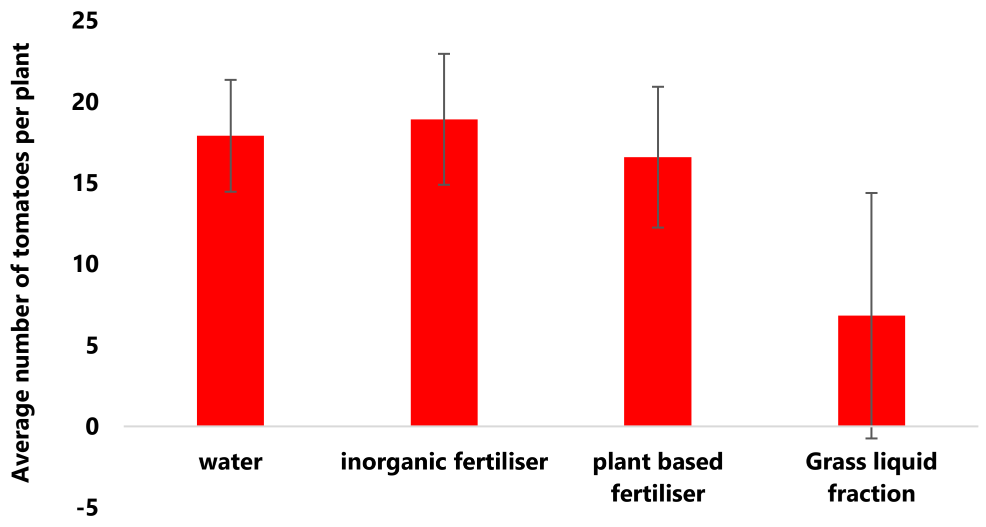

Figure 3: *Overall tomato production obtained with the different treatments*

An interesting overall observation made during the course of the experiment was that the liquid fraction of grass gave worse results than the treatment using only water. To better clarify this result, a test was performed to assess the dynamics of plant-available nitrogen when incubating the liquid fraction of grass with soil in the absence of plants. An incubation with water was performed as a control (Figure 4).

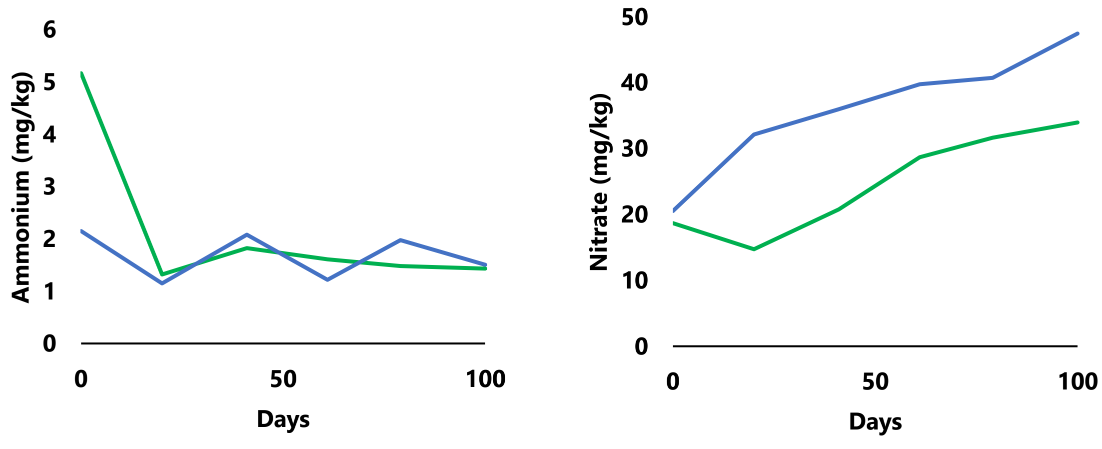

Figure 4: *Ammonium and nitrate availability in soil incubated with water (blue line) or the liquid fraction of grass (green line)*

The incubation test confirmed the observations made during the tomato growth experiment, i.e., the nutrient availability in the soil incubated with only water was higher than the observed when the liquid fraction was added. This result is unexpected and indicates that not only ammonium was being converted into nitrate, as expected, but the nitrate was being consumed by microorganisms, reducing the amount of nitrogen available for plant uptake. As the liquid fraction of grass is rich in sugars, these may have stimulated the growth of organisms that consumed the available nitrogen. This was further confirmed by the observation of fungal growth on the soil from the tomato plants fed with the liquid fraction (Figure 5).

Figure 5: *Fungal growth observed on the soil of the tomato plants fed with the liquid fraction of grass*

3. Conclusions

The results from the present study indicate that the liquid fraction of grass is not suitable for being used as a fertilizer without any pretreatment, as it resulted in plant death and poor tomato production. The removal or sugars prior to the application of this fraction to the soil may increase its nutrient availability and enable its use as a fertilizer.

GRASSIFICATION consortium

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