Evaluation of the Effect of Two Types of Fertilizer on the Growth, Development and Productivity of Hydroponic Green Forage Oat (Avena sativa L.) and Ryegrass (Lolium multiflorum Lam.) as a Biomass Source

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Hydroponic Green Forage (HGF) is increasingly being internationally recognized as an alternative to ensure sustainable biomass production per unit area in the shortest possible time and at the highest possible quality. This research thus evaluates the effect of two nutrient solutions (with two dilutions in each case) applied in the HGF production system for Oats and Ryegrass on the parameters of growth, development and productivity of both species. To this end, a handmade greenhouse was built in which two seed sowing trays were installed with a fertigation system for oats and ryegrass species. The experimental design consisted of the assembly of two modules of 24 seed trays in which HGF Oat and Ryegrass were grown using two nutrient solutions (which were applied according to the position of the seed trays inside the module at level 2 and level 4). The tests showed for the two species evaluated that the use of organic solutions significantly promote the conversion and yield variables of fresh mass per unit area - an increase in the relative growth rate, the net assimilation rate, the crop growth rate and the absolute growth rate; all of these as a measure of crop development. Likewise, when the analysis was conducted, it was observed that the most economic assemblies turned out to be those which used the liquid humus as nutrient solution to 1/20 v.v. and 1/40 v.v. This supports the conclusion that the use of organic nutrient solution can yield high quality HGF exceeding the development parameters of those produced using conventional (synthetic) nutrient solutions.

1. Introduction

Biomass production of different crops is limited by various factors, such as the decrease of land available for sowing, adverse weather conditions (Carneiro et al., 2014), high labour costs. Along of other factors, in the case of the natural pastures, these are, in addition, being affected by the previously mentioned factors and also by the costs in the concentrates and by the use of abundant quantities of irrigation water (which is increasingly scarce and expensive). Due to the above, it forces agricultural producers to seek other options for the biomass production containing a high protein content (ryegrass, sorghum, oat), fresh and plentiful, that are not impacted by climate changes (Weinwurm et al., 2014) and which do not require large areas and which have especially low cost (Rivera et al., 2010). Despite these problems the agriculture is confronted with another even more alarming situation: climatic events as drought and early frosts. The effect of these phenomena is being decreased in protected agriculture while the open landscapes are still out of fully control. This series of problems that challenges the agriculture, also affects the agroproductive systems in terms of the production efficiency, biomass yields and profitability per unit area. Among the alternatives to this situation one finds beneficial to use of plasticultures. To be more specific - the plastic greenhouses can facilitate the conditions to obtain crops with a high efficiency of used water and reducing the maximum effects of climatic factors. In addition, they are able to provide a constant and excellent quality production annually in reduced