SEED SPROUT PRODUCTION AS AFFECTED BY CO_2 AND MICROBIAL INOCULANTS

By

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B.Sc. Agric.Sc.(Horticulture), Ain Shamus University, 1987

M.Sc. Environ. Sc. (Agricultural Science), Ain Shamus University, 2013

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ABSTRACT

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Microgreen pea (*pisum sativum* L.) as salad shoots consumption within two weeks of seedling emergency is a new ready to eat baby leaf vegetable in Egypt. Green barley grass is the young leaves of barley (*Hordeum vulagre*), can take as juice powder and tablets. The internal quality change of microgreen pea shoots and barley green grass is greatly affected by surrounding environmental conditions. Especially increased elevation of carbon dioxide concentration in the air. This work was focused on the impacts of predicted climate changes conditions on the internal quality changes of 14 days old microgreen pea shoots and green barley grass using carbon dioxide concentrations (600 ppm and 800 ppm) compared with ambient air, growing in interaction with three microbial inoculants and their combinations, in tray sprouting method in semi-automated growth chambers. Obtained results showed largest numerical yield of microgreen pea and green barley grass per unit area in 800 ppm CO_2 concentration with increasing about 20% and 37.8% respectively more than ambient air followed by 600 ppm with increasing about 9.2% and 24.2 respectively than ambient air.

Moreover, CO_2 at 800 ppm increased microgreen pea and green barley grass crude protein content 37.8% and 81.9%, lipid 46.9% and 74.3% and energy 19.5 and 35.8% respectively per unit area compared with ambient air while decreased carbohydrate content in microgreen pea by 5.3% and increased in green barley grass by 20.3%. study finding suggested that microgreen pea shoots and green barley grass growing in higher CO_2 concentration maintain optimal internal quality with pronouncing for green barley grass.

Key words: Microgreen Pea, green barley grass, rice straw, CO_2, microbial inoculants, proximate analysis.

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INTRODUCTION

Today, research seems to be confirming that seed sprouts microgreens and baby greens are the function food of the future, as was the food of the past. Therefore, the attention of experts dealing with the healthy nutrition turned more and more towards, the determination of the biological value of the nutritional sprouts and microgreens **(Penas *et al.*, 2008; Abdallah 2008; Marton *et al.*, 2010 and Anwar Dina 2015).** The consumption of green leafy vegetables is recommended due to their high content of vitamins, minerals, and antioxidant phytochemicals, as well as low content of fat and carbohydrate **(Rico *et al.*, 2007).** To increase variety and attract even more consumers , the fresh–cut producers seek for new varieties of leafy vegetables to add to ready-to-eat salad mixtures **(Martinez-so'nchez *et al.*, 2012).**

Pea microgreens and baby shoot greens were recently presented as a ready-to-eat baby–leaf vegetable and is recognized as a popular vegetable in some parts of Asia and Africa which also is gaining popularity in the United States and Europe **(Miles and Sonde 2003; Ebert 2012 and Santos *et al*., 2014).**

Fresh green barley grass produced is of such high quality that it is suitable for green juice production, green flour and even for livestock. Microgreens are usually grown in high light conditions with low humidity and good air circulation. Seed density is much lower than with sprouts. Therefore, microgreens have much better developed flavors and taste than sprouts **(Franks and Richardson 2009).**barley microgreen leaves passes beneficial properties, such as the antioxidant ,hypolipidaemic, antidepressant and anti-diabetic effects **(Kamiyama and Shibamoto 2012),**probably due to wide range of secondary metabolites contained within barley. Some kind of barley micro greens can be harvested more than one time, which renewed its growth after cutting and this behavior could be more effective to increase the total yield per square meter.

INTRODUCTION

Changes in earth's climate have been projected by the end of the 19^{th} century because some atmospheric "greenhouse" gases are increasing at which Carbone dioxide (CO_2) one of them, **(IPCC 2001).** The naturally CO_2 concentration in ambient air is 400 parts per million (ppm). However, doubling ambient CO_2 level (i.e 700 to 800ppm) which is predicted to occurs due to climate changes could make a significant and visible difference in plant growth and yield because CO_2 is utilized by plants for higher rates of photosynthesis during daytime **(Ludwig and Asseng 2006; Süß *et al*., 2015 and Poudel and Dunn 2017).**

However, C_3 Photosynthetic pathways plants as peas are more responsive to higher CO_2 concentration than plants having a C_4 pathway. An increase in ambient CO_2 to 800 ppm can increase the yield of C_3 plants up to 40% to 100% **(Poudel and Dunn2017).**

The main consideration for biological management of plant growth is to utilize microbial inoculants that play a dynamic role in sustaining agriculture by improving their growth performance in a safer way **(Mcdaniel *et al.*, 2014).** Plant response to microbial inoculants could be associated with more than one mechanism at which microorganisms were suggested to have more than one function in stimulating plant growth that results in more than one consequence **(Cakmakci *et al.*, 2007)**, therefore, they have great capabilities to increase plant growth and yield under different conditions**.** These increments could be attributed to different mechanisms such as increasing nutrients uptake through solubilization and degradation of complicated compounds, nitrogen fixation which has special effect on the physiological processes of plants **(Valentine *et al*., 2010 and Zayed Mona 2012)** and stimulating plant growth either by production of plant growth promoting substances such as indole-3-acetic acid, cytokinins and gibberellins which able to encourage progressive effects on the plant growth and development or modulating endogenous plant hormone levels **(Gray 2004; Van Loon 2007; Ortíz-Castro et al., 2008; and Ahemad and Khan 2011).**

INTRODUCTION

In Egypt there is a large amount of agricultural wastes produced annually, after harvesting of grains. One of these wastes is rice straw which produced in an average of 3.5 million ton on year **(Khattab *et al.*, 2009).**

The objectives of the present work were; to study the effect of different microbial inoculants and CO_2 concentration on pea and barley microgreens characters, yield and chemical composition.

REVIEW OF LITERATURE

2.1. Pea microgreens

Legume seeds are important sources of energy and protein in many parts of the world, both in animal and human nutrition **(Kaushik *et al.*, 2010).**

However, their nutritional value may be compromised in part by the presence of undesirable components, known as anti-nutritional factors (ANFs). Legumes have a symbiotic relationship with atmospheric nitrogen (N) fixing bacteria that live in root nodules and that make legumes independent of N fertilization. Legumes such as alfalfa, common vetch, pea and white clover are important forages on many cattle farmers. The main reason of this interest is to enhance the ruminant's performance, because of their high protein contents **(Karabulut *et al.*, 2007*).***

Although, legume seeds contain a moderately high amount of protein, calories, certain minerals and vitamins **(Deshpande, 1992)** their use in food and feed is still limited by their low amount of sulfur- containing amino acids, low protein digestibility and presence of several anti-nutritional components **(Mubarak, 2005).** Soaking is a kind of treatment caused an increase the total amino acids of seeds, in addition, it has been improved the in vitro protein digestibility **(Khattab *e t al.*, 2009).**

During seeds germination the chemical composition changes drastically because biochemical activity produces essential compounds and energy **(Moongngarm and Saetung 2010),** some nutrients transform to bioactive components as a part of these changes. During germination lipids, carbohydrates, and storage proteins within the seed are broken down in order to