Emirates Journal of Food and Agriculture. 2016. 28(6): 398-401
doi: 10.9755/ejfa.2016-04-340
http://www.ejfa.me/

REGULAR ARTICLE

# Lettuce growth in extreme conditions

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## ABSTRACT

Over-fertilization is one of important environmental problems, but also affects plant nutritional status. To investigate the influence of over-fertilization on leaf mineral content, lettuce was hydroponically grown at higher nutrients concentrations. The experiment revealed no significant differences in leaf mineral content and root length between treatments, but we have observed much bigger variability of data at the lowest concentration. Similar trend has been observed comparing mobilities: more nutrients there are in a solution, significantly smaller the variability between plants is. Obviously, plants need to compete between each other at lower nutrients availability for their uptake, which increases variability, but not at higher.

**Keywords:** Nutrients; Lettuce; Hydroponics; Mobility

## INTRODUCTION

Fertilization practices unfortunately often lead to over-fertilization (Vitousek et al. 2009), at least in smaller system such are gardens. It might bring some advantages, especially with relatively fast growing crop as lettuce, but there are many disadvantages too, since excessive nutrients are washed into rivers and streams or they remain in soil. It might not be such a problem in big, intensive systems, where every unnecessary cost is eliminated, so rational amounts of fertilizers are applied. But what about small surfaces? There are many studies reporting that gardens are over fertilized due to two reasons: first because they are usually smaller and you don't need the amount of the fertilizer you usually bought and the second is human nature: as we like to give candies to the kids, in the same way we like to (over)fertilize our plants. There might be even third reason – most of the guidance have been prepared decades ago, before the "times of abundance". We probably should now look at the guidelines from the perspective of too many nutrients and not too little?.

However, information on lettuce response to high supply of other nutrients is scarce (Albornoz and Heinrich Lieth 2015; Andriolo et al. 2005) and are mostly dealing with only one element change: phosphorous (Johnstone et al. 2005; Soundy et al. 2001b; Soundy et al. 2001a; Azcón, Ambrosano, and Charest 2003; Santos et al. 2004), nitrogen (Soundy et al. 2005; Azcón, Ambrosano, and Charest 2003) or organic fertilizers (Papathanasiou et al. 2012; Thorup-Kristensen 1999; Thorup-Kristensen 2006).

Several studies on lettuce already suggest the rationalization of the use of fertilizers by half, since no statistical differences between treatments regarding growth parameters have been observed when decreasing the nutrients (Cometti et al. 2008; Maruo et al. 2002; Chen et al. 1997). Chen et al. 1997 show that it is possible to reduce the concentration of the nutrient solution to levels as low as 10% of the original ionic strength of the solutions commonly used in hydroponic crops in recirculating systems, without incurring in productivity loss.

Ünlükara et al., 2008 has studied the response of lettuce to salinity of irrigation water and confirmed that it is moderately sensitive to salinity, but the results are variety specific. Anyway they have focused on salinity induced by chlorides and sulphates and not nutrients in general. On the other hand, Andriolo et al., 2005 and Albornoz and Heinrich Lieth, 2015 reported reduction of fresh yield and plant growth at higher salinity levels at systemically changing total nutrient concentrations. The leaf mineral content increased for several macronutrients (N, P, S and Mg) with increasing

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**Received:** 08 February 2016; **Revised:** 17 March 2016; **Accepted:** 18 March 2016; **Published Online:** 08 April 2016