PURDUE UNIVERSITY | Extension

Horticulture & Landscape Architecture
ag.purdue.edu/hla

HO-309-W

Optimal Fertilizer Solution Concentration for Hydroponic Lettuce Production

Authors: Alexander Miller, Petrus Langenhoven, and Krishna Nemali
Department of Horticulture and Landscape Architecture, Purdue University

Questions:
knemali@purdue.edu
765-494 8179

Fertilizer requirements of lettuce may vary by variety and growth rate. Earlier research at Purdue University shows that lettuce varieties grown in the Midwest differ in their growth rates. Since fertilizer requirements of a crop should be based on growth rates, fast-growing varieties may require higher concentration to ensure optimal plant nutrient levels. However, a higher fertilizer concentration for a slow-growing variety can increase the levels of nutrients in the tissue, higher levels of nitrates in the leaf tissue are not desirable for human health.

In addition, lettuce is grown in different types of hydroponic production systems. Examples include nutrient film technique (NFT), deep water culture (DWC) and constant flood table (CFT) methods. In the NFT system, only a small portion of roots are in contact with fertilizer solution. In CFT and DWC, most of the root system is submerged in the fertilizer solution. Information on the optimal concentration or electrical conductivity (EC) of the fertilizer solution for different lettuce varieties grown in NFT and CFT hydroponic production systems is not currently available.

This article describes results from a study, conducted at Purdue University in West Lafayette, Indiana, that tested several varieties of lettuce under different fertilizer concentrations using NFT and CFT production systems. The purpose was to identify the optimal fertilizer concentration in the solution for different varieties (Table 1) under NFT and CFT production systems. We grew 24 varieties of lettuce at four target EC levels of 1.3, 2.0, 2.9, or 3.9 dS/m in NFT and CFT systems (Figure 1). After four weeks, we harvested plants and measured the average dry weight (directly correlated to fresh weight) of plants in each treatment.

Our results indicated that the optimal EC level of the fertilizer solution was not affected by either the production system or variety. Lettuce growth was comparable between the two production systems at any EC level. Regardless of growth differences, optimal EC range was similar among varieties. Lettuce growth was on average higher in the two lower EC treatments (1.3 and 2.0 dS/m) and lower at the two highest EC levels (see Figure 2). Plants that were grown at 2.9 or 3.9 dS/m solution EC likely experienced osmotic stress (due to increased concentration of fertilizer salts), which inhibited their ability to uptake water and nutrients. Based on these results, we recommend that growers use a nutrient solution with an EC level of 1.3 dS/m for growing lettuce varieties in both NFT and CFT production systems. NFT and CFT production systems performed well across all varieties used in this research trial.

Table 1: Tested varieties by Color and Group

Group	Color	Variety
Leaf	Green	Nevada
		Walkmann's Dark Green
		Black Seeded Simpson
	Red	Red Sails
		Cherokee
		New Red Fire
Romaine	Green	Salvius
		Dragoon
		Amadeus
	Red	Breen
		Truchas
		Intred
Butterhead	Green	Butter Crunch
		Adriana
		Natalia
		Rex
	Red	Alkindus
		Skyphos
		Salanova Red Butterhead
Oakleaf	Green	Salanova Green Oakleaf
		Cedar
	Red	Navara
		Red Salad Bowl
		Salanova Red Oakleaf

Figure 1. Lettuce plants grown in NFT (white channels) and CFT (black trays) production systems at different fertilizer EC levels during spring.

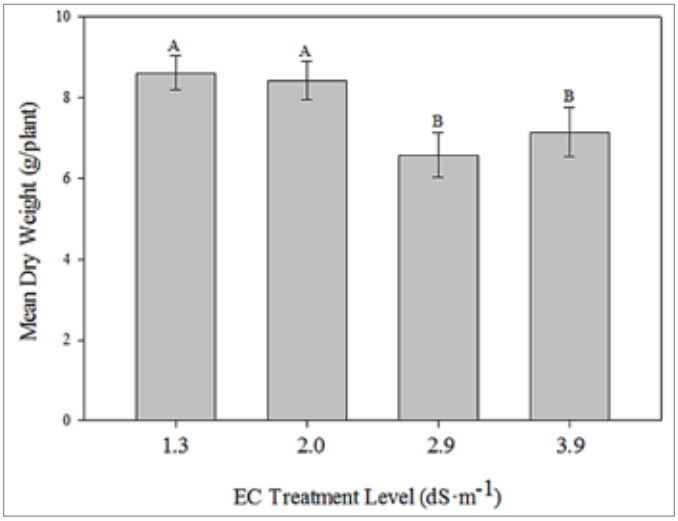

Figure 2. Shoot dry weight (g/plant) of lettuce (average of 24 varieties) grown at each EC treatment. Statistically different means are indicated with different letters.