Comparison of Hydroponic Production Systems Nutrient Film Technique and Deep Water Culture when Circulating Fresh or Recycled Solution

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Introduction

- Hydroponic production of leafy greens is a rapidly growing industry with many types of production systems.
- Nutrient Film Technique (NFT) and Deep Water Culture (DW) are two of commonly used systems that are commercially sold.
- An NFT system uses a much less of the water that is required by DW

Objectives

- Experiment 1, to compare NFT and DW production systems when circulating the conventional recycled solution and fresh solution.
- Experiment 2, is to look at nutrient uptake in plants grown in recycled and fresh solutions

Materials and Methods

General methods for both experiments

- Seeds given 1 week to germinate in 1in^2 Rockwool cubes before placed in systems
- Plants recieved 15-5-15 and 21-5-20 Peters Excel commercial fertilizers in 3:1 ratio while the EC was maintained at 1.8 ds/m
- Both experiments were in a randomized block design
- Data analysis done through ANOVA and Tukey's HSD (alpha = 5%)

Experiment 1:.

- Butter head Lettuce (*Lactuca sativa*) "Rex"
- 2 treatments
- Fresh treatment was dumped 3 times a week and replaced with new solution
- Recycled treatment , new water is added to the existing solution. Then EC and pH are corrected.
- Plants were grown for 4 weeks and then harvested for fresh weights

Experiment 2

- Green leaf Lettuce (*Lactuca sativa*) "Black Seeded Simpson"
- 2 treatments
- Fresh treatment , 2 L of Fresh nutrients supplied everyday
- Recycled treatment, EC and solution volume data was used to calculate how much solution was needed and at what EC
- Harvested after 3 weeks of growth for nutrient analysis of the tissue and water.

Results

Figure 1. shows the experimental set up for a single treatment (left) and then NFT (top right)) and DW (bottom right)

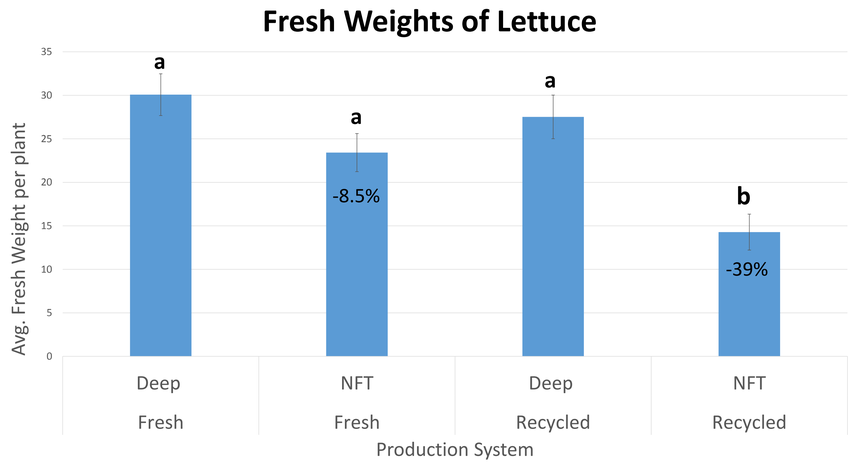

Figure 2.

- Shows that Deep water/ Fresh and NFT/ Fresh are not significantly different from each other with only a 8.5% difference in fresh weight
- Deep water/ Recycled and NFT/ Recycled are however significantly different with an 39% difference in average fresh weight
- The only plants that were significantly different due to their treatments and sub treatments were NFT/ Recycled

Treatment	N	P	K	Na
	%			
Daily Fresh	3.76 a	0.53 a	4.19 a	0.19 b
Recycled	2.43 b	0.26 b	2.53 b	0.32 a

Figure 3.

- Indicates nutrient deficiency in recycled solutions which explains decreased growth
- Increased sodium in the recycled nutrient solution puts the plant under additional stress

Figure 4: Comparison of lettuce grown in DW (left) and NFT (right)

- Deep water shows much healthier and larger leaves than the NFT system

Discussion:

- Experiment 1 showed that Deep water treatment showed increased growth when compared to the NFT system.
- Plants grown in fresh solution showed increased growth when compared to recycled solution.
- Plants grown in recycled showed evidence of nutrient deficiency
- Experiment 2 showed decreased growth in the recycled treatment attributed to low Nitrogen, Phosphorus, and Potassium as well as high sodium

Conclusion:

- The Deep water systems' large supply of water in both Fresh and Recycled solutions increase crop growth due to more available nutrient.
- The NFT system in both systems shows less growth which may be caused by minor drought.
- Recycled solution doesn't supply the proper amount of nutrients to the plants like the Fresh does. Plants grown in recycled solution also exhibits drought and salt stress.
- For growers that already use NFT it would be beneficial to use fresh water periodically rather than continuously recycle the solution