

Growers' Choice

Which system is the right one for your lettuce production?

by ANNE BENNETT-CIAGLIA

The implementation of a growing system for production of year-round and pesticide-free fresh lettuce has clearly been driven by increased population and consumer demand. The type of system an operator and/or investor will ultimately choose to meet this demand, however, depends on several factors, i.e., business objectives, available capital, operating costs and yields that will provide sustainability as well as profitability.

Prior to start-up of a greenhouse operation, or when expanding an already established one, is the time to decide what type of growing system to install and if an automated system is the best choice to enable you to reach overall objectives of your business plan.

Your options

There are three main hydroponic growing systems available today:

- **Non-automatic hydroponic/Stationary NFT**—Gutters are stationary and set to a certain distance from each other.
 - Manual steps:* Substrate filling, seeding, transplanting, adjusting of gutter distance, movement of gutters through greenhouse, harvesting and cleaning of gutters
 - Growing area:* Walkways are required to give access to the plants during the growing process. If using different gutter types for each phase in the growing cycle, the growing area can be utilized efficiently, but several rounds of transplanting will be needed.
 - Crops:* Lettuce, herbs
- **Fully automated hydroponic NFT**—Fully automated system. No transplanting required, as seeded directly into narrow gutters. No manual labor needed in the greenhouse.
 - Manual steps:* Every phase in the growing process is automated—substrate filling, seeding, movement through the greenhouse, transportation by conveyor belt to harvesting area, harvesting and cleaning of gutters.
 - Growing area:* No walkways needed. Gutters are moved automatically through the greenhouse. The distance between the gutters is adjusted automatically, giving the plant just as much space as it needs in each phase.
 - Crops:* Baby leaf lettuce
- **Floating rafts/Deep water culture**—Plants are placed in floating cassettes in a pool of nutrient solution. The roots are in constant contact with water.



Non-automatic hydroponic/Stationary NFT system.

Manual steps: Substrate filling, seeding, transplanting harvesting and cleaning of trays is done manually.

Growing area: Access points needed for transplanting, as plants are repeatedly transplanted into a different raft to adjust for the needed spacing. The plants are typically moved/pushed automatically from germination area in greenhouse to the harvesting area during the growing process, minimizing need for walkways.

Crops: Lettuce, herbs or baby leaf lettuce

For your consideration

The answer to the question of *which* system to install depends on one key factor: efficiency. And the most important components to determining if efficiency can be achieved are yield and labor. Each of the three methods for lettuce production feature different yields per square foot, as well as the amount of

labor that will be necessary to operate the greenhouse.

Yield (pounds of lettuce per square foot) in a greenhouse is expensive when compared to the growing area in an open field and, therefore, must yield more to make it profitable. In addition, the more advanced and costly the system, the higher yield is needed to achieve profitability. And the more expensive to build and operate a greenhouse (i.e., heating and cooling, depending on location), the more efficient the growing system needs to be.

If you're in a perfect environment for lettuce production (land is inexpensive, no heating needed and labor is readily available), an investor doesn't necessarily have to opt for the most advanced growing system. However, if the location is such that land is expensive and the climate requires significant energy for heating due to snow loads in winter and/or cooling in warmer months, as well as the possible need for hurricane-proof structures, the level of capital expenditure would require a more highly advanced, efficient growing system.

One good metric to consider when choosing a growing system for your greenhouse is the percentage of actual growing area compared to the total greenhouse area (net grow area). Automated and floating raft systems typically require little or no space for walkways to access the plants during the growing cycle, which increases the net grow area. It's not only important how large the net grow area, but also how efficiently it's utilized, i.e., the spacing between the plants.

Most growing systems space the plant distance efficiently toward the end of the growing cycle. The space efficiency in the ►

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early stages varies dramatically. Even after a small plant has been transplanted from a seedling tray to a growing gutter, it requires very little space compared to a mature plant, but the distance between plants is often set and based on the space needed for a fully-grown plant—leaving a lot of space unused during the initial growing phase.

To optimize the growing area, the principle must always be to give the plant as little space as possible, but as much as it needs for healthy growing. Subsequently, to achieve this, the space between the plants must be adjusted during the growing process. A fully automated growing system places the seedlings directly adjacent, and as the plants grow, the distance between the plants is automatically adjusted.

The second key component in the growing system decision-making process is labor. Labor, as mentioned above, has become a prohibitive factor for many growers. The required labor to operate a hydroponic system varies significantly. While some simple systems are operated completely manually, the most advanced systems don't require any interaction with the plants.

Yield potential and labor are connected in some systems. For example, in a non-automatic gutter system, the space efficiency (thus yield)



A fully automated hydroponic NFT system.

could be increased significantly if workers could permanently adjust the gutter distances according to the constant growth in plant size. Yield per net growing area could come close to the yield of an automated system, but would require considerably more labor and a significant loss of space to enable manual access to the plants.

Additionally, transplanting is labor intense. Assume a non-automated system would have one transplanting stage from tray to channel and one addi-

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tional transplanting stage to a larger channel as the plant size increases. When analyzing the total labor cost for any system, we propose to look at three types of labor:

- **Direct growing system**—The labor needed to operate the actual growing system. This typically takes place in the greenhouse (activities: transplanting, gutter/tray movement within the greenhouse, as well as to and from the greenhouse).

- **Plant processing and system processing labor**—Harvesting, cutting, cleaning of growing equipment (trays and gutters), medium filling and seeding.

- **Supervision and maintenance**—All activities not directly related to the growing operation system, such as maintenance, repairs, system management and supervision.

The labor needed for each category differs significantly, depending on the growing system used. Non-automated will require minimal maintenance of the growing system, but may need up to 10 workers per acre for medium filling, seeding, transplanting, cleaning and movement of gutters and trays.

The most advanced automated gutter system has automated all steps and requires no workers in the direct growing system and plant processing and system processing. The only labor needed is in supervision and grower expertise and maintenance.



Floating rafts/deep water culture system.

If you're considering switching systems or are just jumping into hydroponic growing, hopefully these guidelines will assist you in choosing the right growing system for your crops and operation. [IG](#)

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