

Designing the Salad Bar Corp. Plant Factory Growing System

Joel L. Cuello, Ph.D.

Eiichi Ono, Ph.D.

The University of Arizona



Research at Dr. Cuello's Lab



Our lab has been working on the development of novel plant growing systems. Some of our research studies have been funded by NASA.



Cosmo Farm Factory

Cosmo Farm Factory #1



- 5,000 lettuce heads daily
- 700 m² floor area,
125 m² land area
- 10 growing levels
- Construction cost:
approx. \$6 million (US\$)

Three Steps in Lettuce Production



1. Nursery Room Germination

14 days

Fluorescent lamps



2. Growth

14 days

RED LEDs



3. Harvest

Automated conveyor system

Light Sources



Fluorescent lamps
for germination



AC Driven

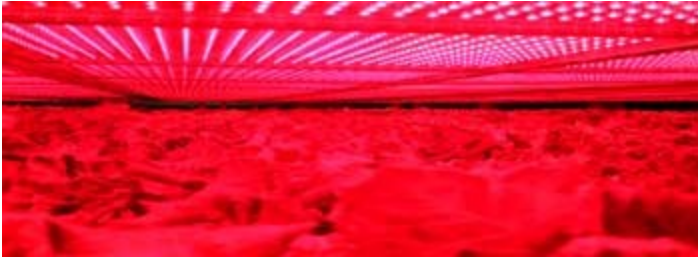


LEDs for
growth



DC Driven

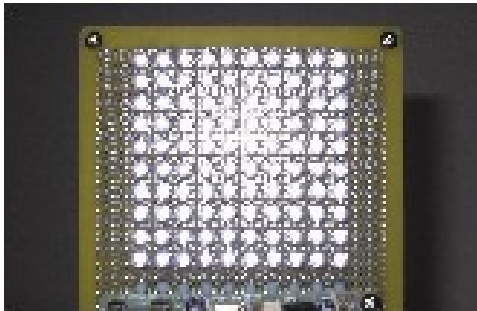
Three LED Panel Configurations



Lettuce can be grown under red LEDs exclusively. Red LEDs are the most inexpensive LEDs. Some crops do not grow under red LEDs alone.

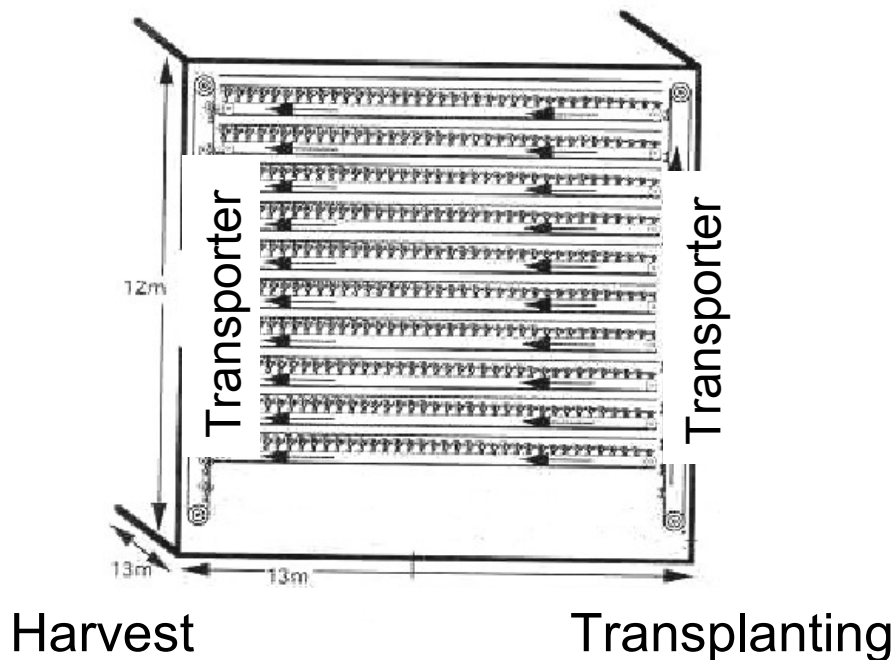


LED panels which have both blue and red LEDs have been tested. Typically, B/R ratio of 1/10 (output base) shows best results.

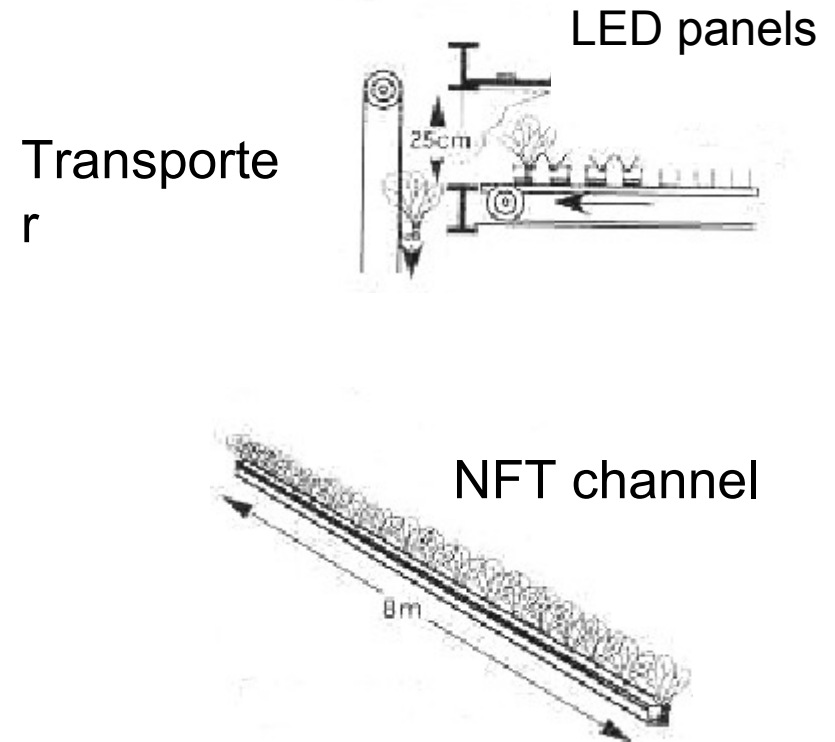


Like natural light, white LEDs work fine for most crops. However, white LEDs are still expensive and their light output is also limited.

Cosmo Plant Growth System



NFT hydroponic system

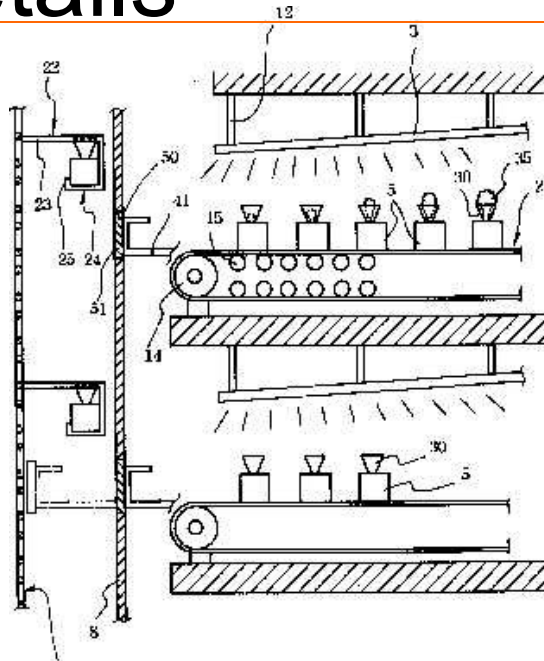


Cultivation area: 800 m² in 169 m² building

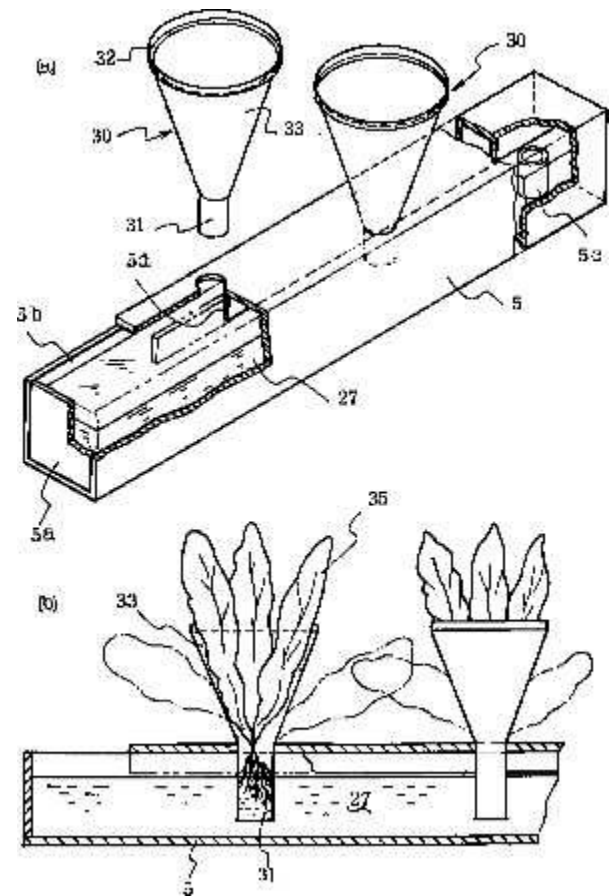
Production capacity: 150 million lettuce heads per year

(Source: Watanabe, 2001)

Details



Cosmo farm utilizes mechanical conveyors.



Products



Cosmo Farm sells leaf vegetables as packaged and precut vegetables.

Competitors

La planta Co. LTD. sells packaged plant-factory and greenhouse-grown vegetables via web site in Japan.



Trial set \$20 (1,980 yen)

Web retailer in Japan

感動食品専門スーパー



Oisix, a Tokyo based company sells organic vegetables via web site.

大粒 とちおとめ 約1kg

産地：栃木県 須藤紀明さん他 Oisix基準（薬減化無）当地比



イチゴの名産地としても有名な栃木にあって、ちょっと評判になっている若手農家さん達のグループがあります。それが「栃木おいしい会」。彼らの「おいしさ」と「安全」にこだわって育てた「とちおとめ」は糖度も高く、色もツヤツヤ！つぶれないように、専用の箱にお入れしてお届けしますので、贈り物にもぴったりですよ！ 1/31（月）まで販売

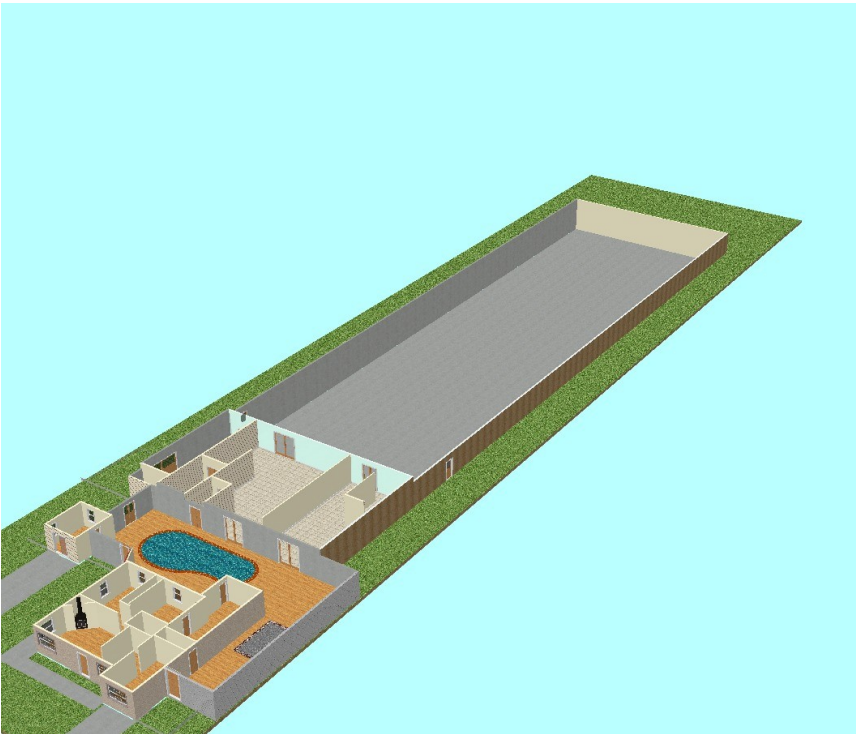
塩トマト 約1kg

産地：熊本県 池田博光さん他 Oisix基準（薬減化減）当地比



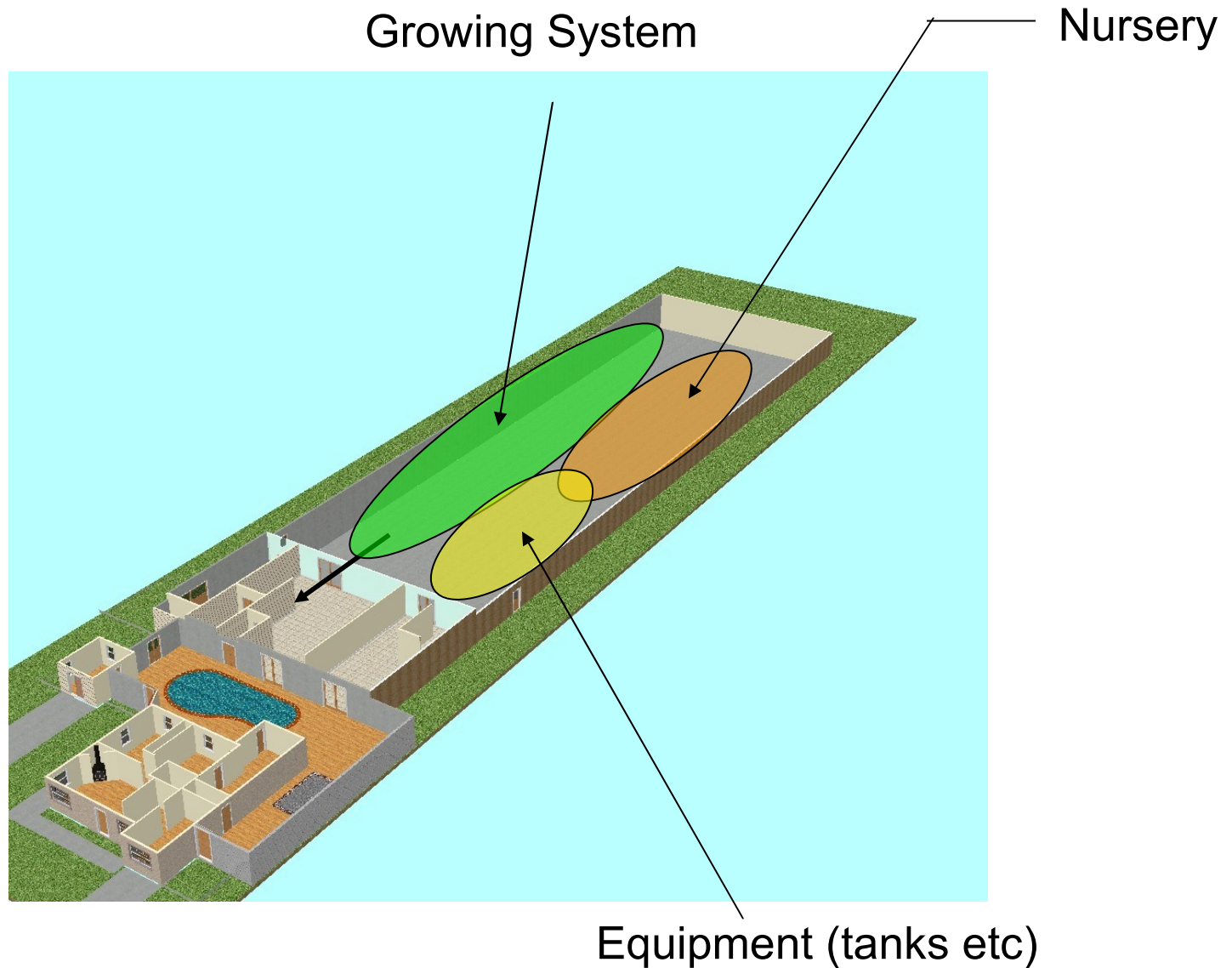
「塩トマト」と聞かされたら、どんなトマトを想像しますか？しょっぱいトマト？いえいえ、しょっぱいどころか、とても濃厚でフルーティーなトマトなんです。では、なんで「塩」なんて名前が付いているのでしょうか？ 2/10（月）まで販売

Salad Bar Corp. Plant Factory

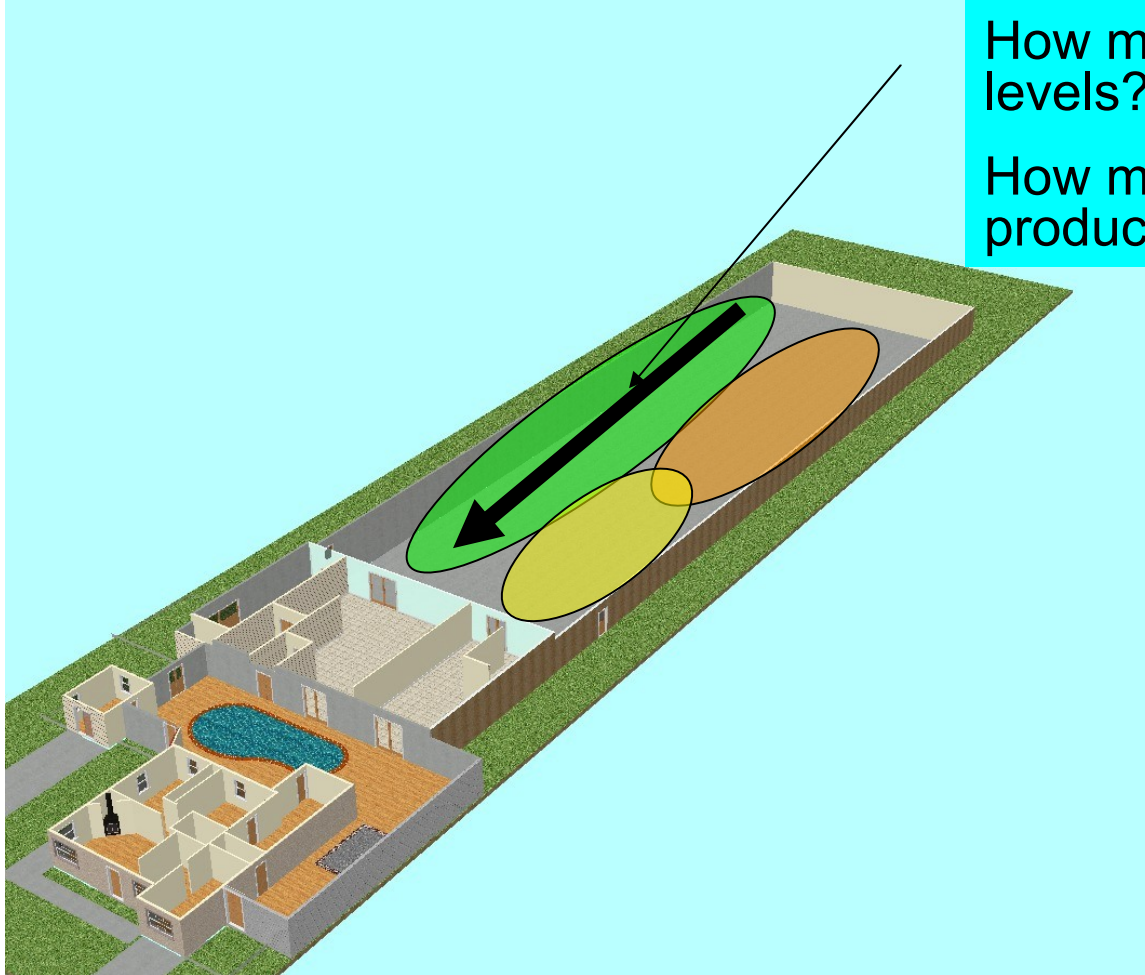


- ____ lettuce heads daily
- ____ m² floor area,
____ m² land area
- ____ growing levels
- Construction cost: ____

Salad Bar Corp. Plant Factory



Design Specifics



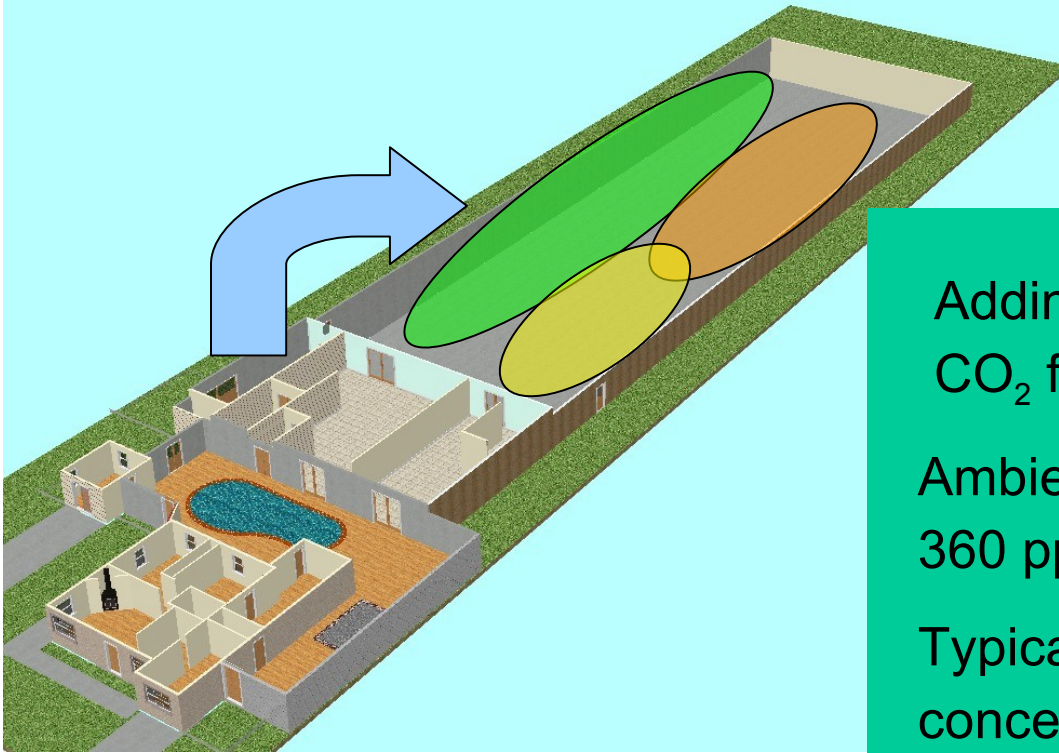
How many plant species?

How many growing levels?

How much daily production?

CO₂ Enrichment

Recycle CO₂ from Co-Gen

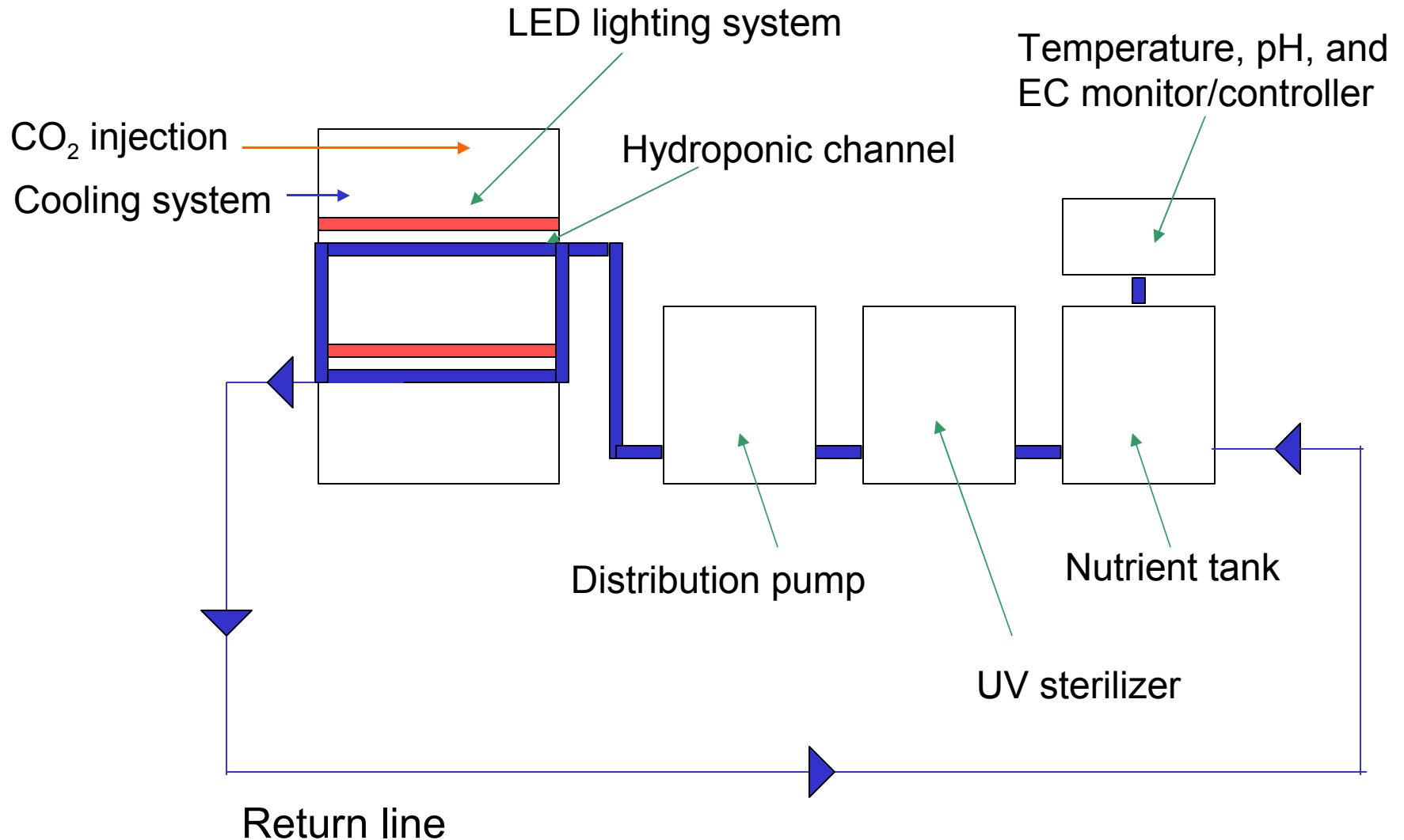


Adding CO₂ gas is needed.
CO₂ from Co-Gen can be used.

Ambient CO₂ concentration is
360 ppm.

Typical Plant Factory CO₂
concentration is 700 - 1,000 ppm

Possible System Diagram



Questions

Identify features from Cosmo Farm Plant Factory design that should be included in the Salad Bar Corp. Plant Factory.

Same for the ones that should be excluded.

This is only a first step to systematically design the Salad Bar Corp.'s Plant Factory design.