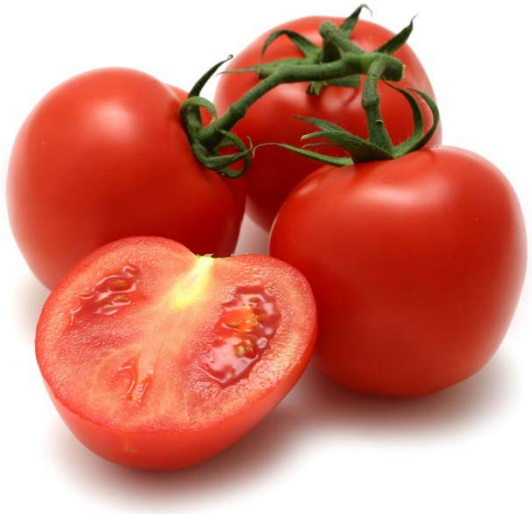
Ten things you should know when starting a CEA business



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#1

Food Safety Matters

Good Agricultural Practices

Any procedure or activity that reduces microbial risks to fruits and vegetables on the farm or in the packinghouse.

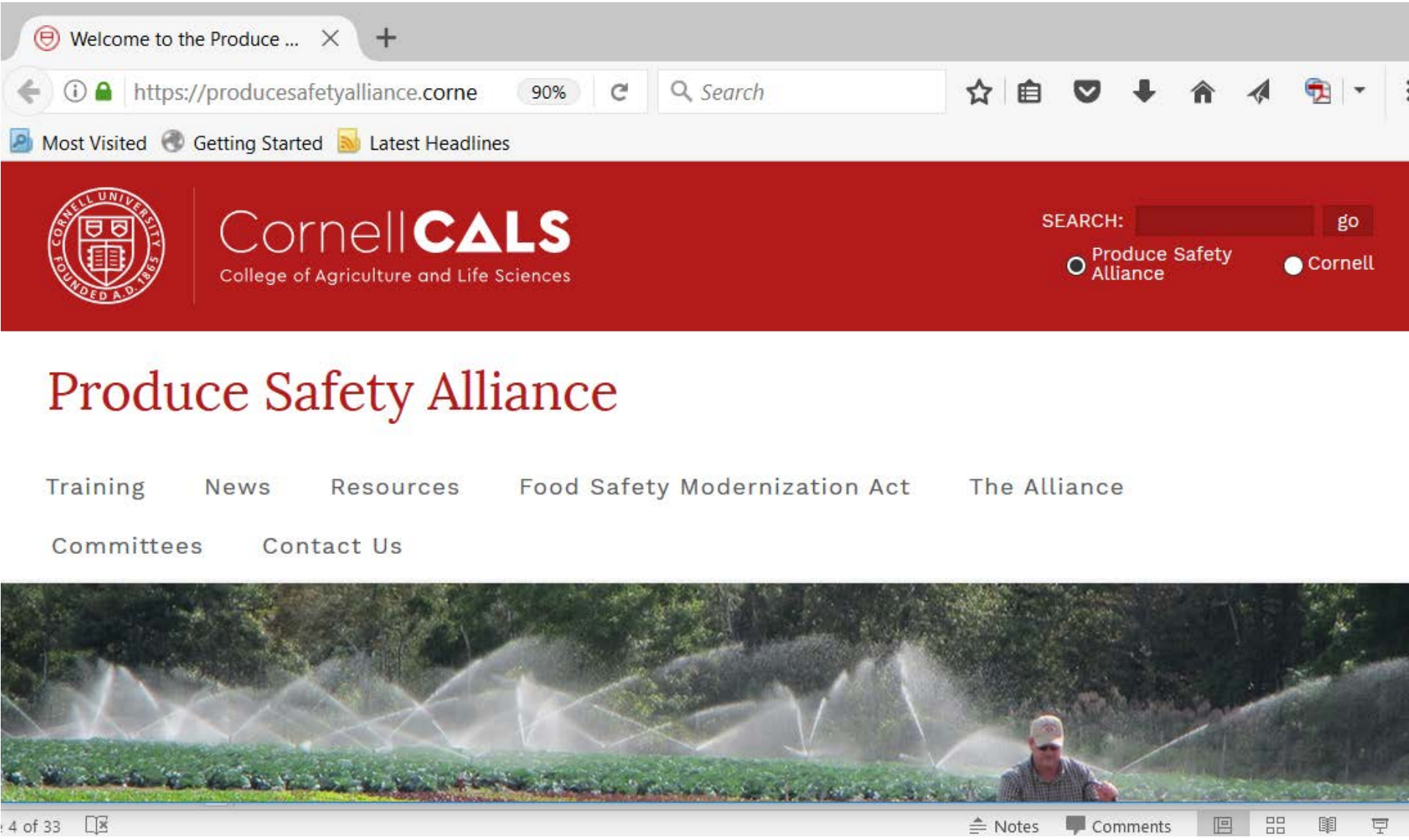
Source: Elizabeth Bihn, Cornell Food Science

Areas for GAPs Implementation

- Worker Training
- Water
- Manure and Compost
- Wildlife (Pest) Control
- Sanitation
- Transportation
- Traceability

Source: Elizabeth Bihn, Cornell Food Science

https://producesafetyalliance.cornell.edu/



#2

Insect Control

Insects

Common problems:

- Aphids (Lettuce)
- Thrips (Tomatoes)
- Whiteflies (Tomatoes)
- Spidermites

- Have an IPM plan (exclusion, scouting, treatment)
  - NYS IPM Betsy Lamb eml38@cornell.edu
- Use of registered pesticides
- Biologicals (ex: aphidius colemani for green peach aphids)
- Removal of lower leaves (tomato)

#3

Dastardly Diseases

Disease

Common problems:

- Powdery Mildew
- Botrytis
- Basil Downy Mildew
- Pythium root rot

- IPM
- Cornell Plant Disease Diagnostic Clinic
- Use of registered fungicides
  - Ex: Milstop (potassium bicarbonate)
  - Ex: Serenade (Bacillus subtilis)
- Environmental control (low humidity, air flow)
- Removal of lower leaves (tomato)

#4

Water Quality

Open vs. Closed Irrigation

Open system: any excess water leaches to floor/ground

- If excess water applied this can control the build up of salts
- Can use poorer quality water

- Closed system: excess water captured and reused
  - disinfestation to control pathogen spread
  - nutrient imbalances and salt build up over time
  - saves water and fertilizer
  - start with better quality water

Water considerations

- Test water source before starting an operation
  - Specific elements, pH, alkalinity
    - Cornell Nutrient Analysis Lab, Agro One, etc.
  - Water volume
- Filtration systems
  - Reverse Osmosis, Ion Exchange, Activated charcoal (chlorine removal)
- Disinfestation systems
- Water disposal/treatment
  - Municipal treatment, constructed wetland

#5

Certified Organic?

Organic

Meets National Organic Program (NOP) Standards

- avoidance of most synthetic chemical inputs (e.g. fertilizer, pesticides, antibiotics, food additives, etc), genetically modified organisms, irradiation, and the use of sewage sludge;
- use of farmland that has been free from synthetic chemicals for a number of years (3);
- keeping detailed written production and sales records (audit trail);
- maintaining strict physical separation of organic products from non-certified products;
- undergoing periodic on-site inspections

Organic Hydroponics?

National Organic Council

- “The central theme and foundation of organic farming is the maintenance and management of organic matter in the soil, along with the diverse populations of organisms that are the foundation of soil ecosystems.”

Organic Hydroponics?

National Organic Program (the rule makers)

“Organic hydroponic production is allowed as long as the producer can demonstrate compliance with the USDA organic regulations”

Currently be re-evaluated

#6

Lighting Costs

Light is key for year-round production

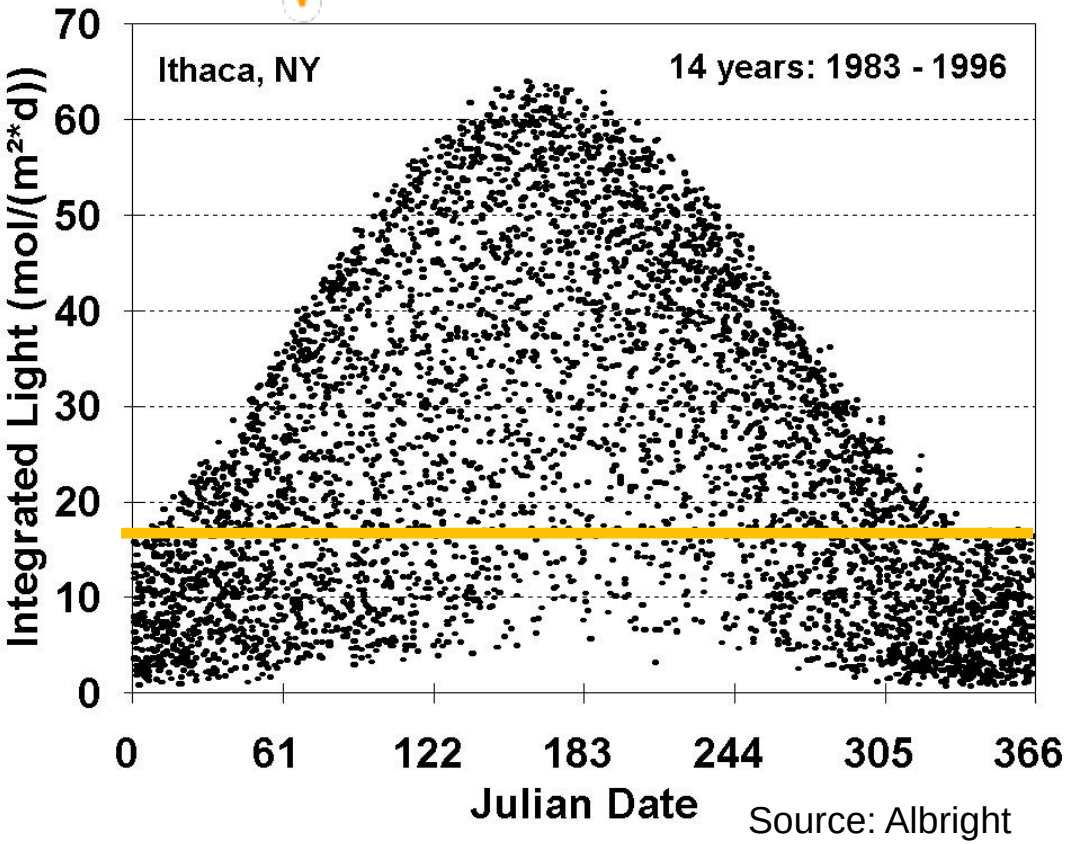
Target 17 mol/m^2/d

Without added light

- 105 days to harvest (winter)

With added light

- 35 days to harvest (year-round)



Source: Albright

Location Matters

Target 17 mol/m^2/d

Central New York (Ithaca)
Averaged over year
70% light from sun
30% light from lamps

SE New York (NYC)
Averaged over year
85% light from sun
15% light from lamps

Leaf Tip Burn (Calcium deficiency at high light)

Lighting 1 acre greenhouse

Fixture	Fixtures to light 1 acre	Cost of fixtures ($)	Fixture cost ($/sf)
PAR Source 1000W DE HPS	473	$192,511	$4.42
Gavita Pro 600W SE HPS	742	$218,148	$5.01
Heliospectra LX602-G LED (100% on R/W/B)	1,049	$1,939,601	$44.53
Illumitex PowerHarvest W 10 Series LED	929	$1,206,771	$27.70
LumiGrow Pro 650™ LED (100% on R/W/B)	1,060	$1,451,140	$33.31
Philips GreenPower LED Toplighting DR/B – Med. B	1,569	$784,500	$18.01
Valoya Model R150 NS1 LED	4,216	$4,114,816	$94.46

Lamps on for 2592 hrs/yr

Target light: 200 µmol m^{-2} s^{-1}

Lighting 1 acre greenhouse

Fixture	kWh electricity (1 yr.)	Electricity cost (1 yr.)	Electricity cost ($/sf)
PAR Source 1000W DE HPS	1,320,965	$138,701	$3.18
Gavita Pro 600W SE HPS	1,345,067	$141,232	$3.24
Heliospectra LX602-G LED (100% on R/W/B)	1,769,370	$185,784	$4.27
Illumitex PowerHarvest W 10 Series LED	1,226,889	$128,823	$2.96
LumiGrow Pro 650™ LED (100% on R/W/B)	1,554,593	$163,232	$3.75
Philips GreenPower LED Toplighting DR/B – Med. B	878,270	$92,218	$2.12
Valoya Model R150 NS1 LED	1,457,893	$153,079	$3.51

Lamps on for 2592 hrs/yr

Target light: 200 µmol m^{-2} s^{-1}

#7

Warehouse Farm Energy Costs

FarmedHere Bedford, IL

Energy Consumption: Greenhouse vs. Plant Factory

- Kale Harbick
- harbick@cornell.edu
- www.cornellcea.com

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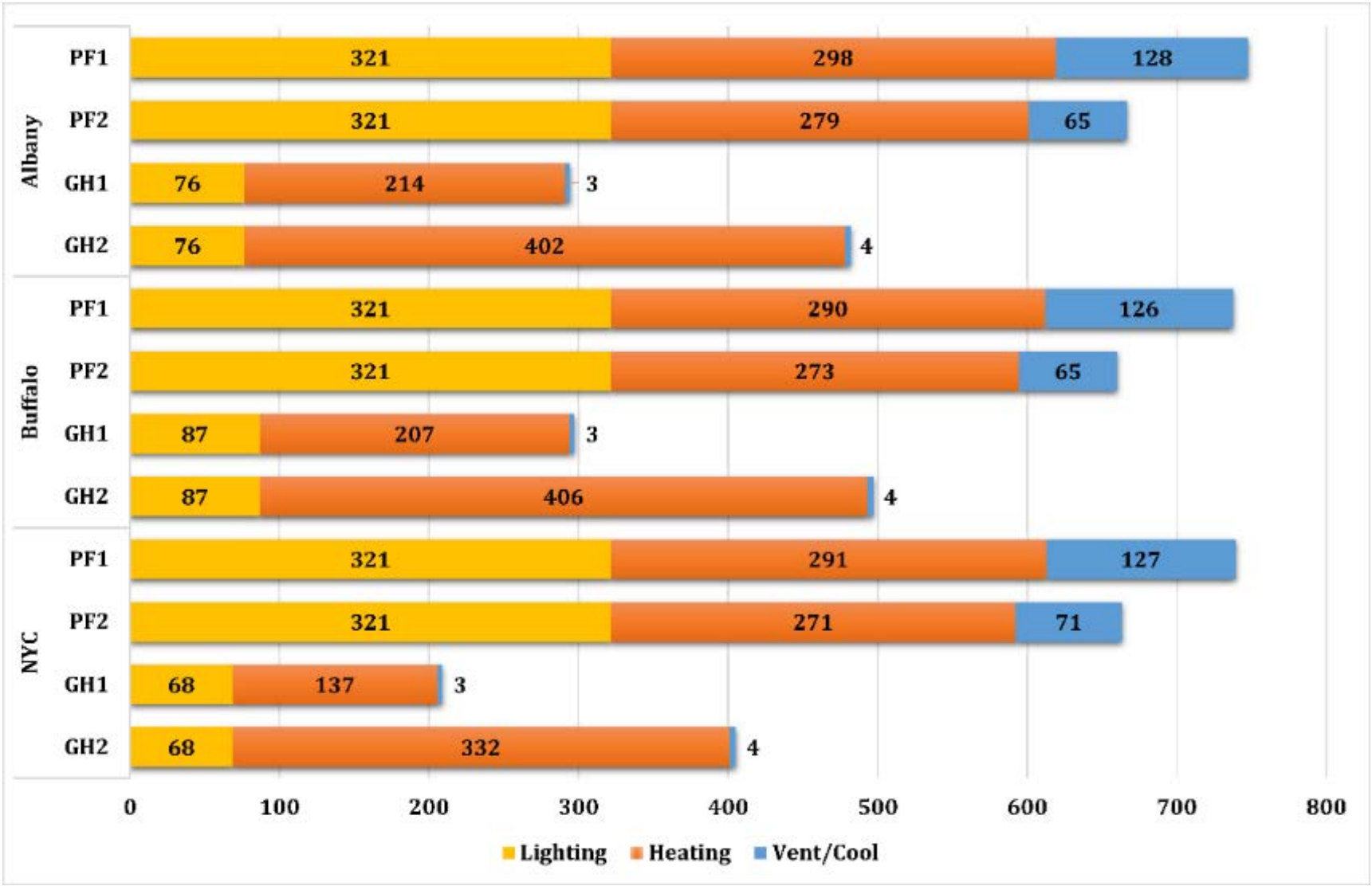
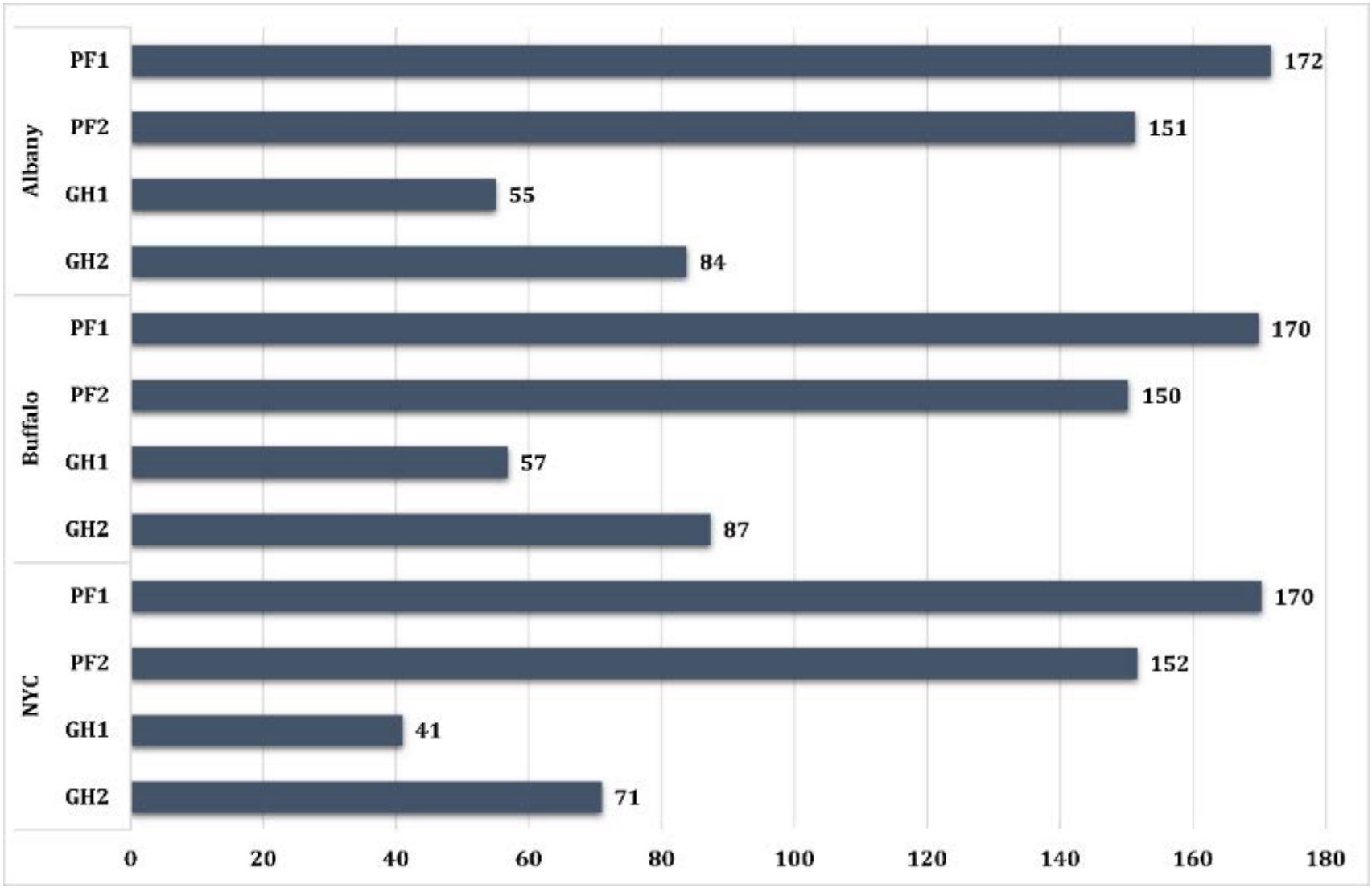
Results – EUI (kBtu/ft^2/y)



Results – CO_2 (lb/ft^2/y)



#8

Marketing Misconceptions

Marketing misconceptions

- Everything that is grown will be sold (marketing)
- Exist with one customer (believe the produce mgr)
- Customers will be loyal
- Customers will understand if crop fails
- Under estimate input costs, over estimate price market will pay

#9

Labor Misconceptions

Labor misconceptions

- Labor will be there
- Experienced Head growers/greenhouse managers are waiting to be hired
- Don’t have to work weekends / holidays

#10

Production Misconceptions

Top misconceptions - production

- Full production from the start
  - Lou's adage: "have sufficient cash flow to account for no crop production in first year and half of optimal in second year"
- Don't understand the interacting biological systems (plants, pests, bacteria in solution)
- "It is all science, protocols"
- Nothing will breaakdown
- Can trust computer control
- Seasons!! Need to go through a full year to learn.

Thank You!

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