

Maximizing US & Canadian Greenhouse Profit Margins for Fruits, Vegetables and Cannabis

There are about 1.5 billion square feet of greenhouse space in the United States and 300 million square feet in Canada growing fruits & vegetables, flowers and in states/provinces where it is legal - *Cannabis*.

United States Greenhouses

Fruits & Vegetables	Floriculture & Nurseries	Cannabis	Other Crops
100 million sq ft	1.25 billion sq ft	100 million sq ft	50 million sq ft

Source: spoon.usda.gov

Canadian Greenhouses

Fruits & Vegetables	Floriculture & Nurseries	Cannabis	Other Crops
220 million sq ft	50 million sq ft	20 million sq ft	10 million sq ft

Source: spoon.usda.gov

As per the USDA and Agri-Canada, the annual revenue of combined US greenhouse space excluding *Cannabis* is about USD \$15 billion (\$10/sq. ft.) and about USD \$2.5 billion (\$8/sq. ft.) in Canada. Greenhouse revenues and gross profits vary by crop and location so this is an approximation. Greenhouse fruits & vegetables generate an average revenue of \$7/sq. ft., floriculture & nurseries \$12.50/sq. ft. and *Cannabis* in the \$50-\$200/sq. ft. range.

The top three fruits & vegetables grown in US and Canadian greenhouses by harvested area are tomatoes, cucumbers and peppers. The harvested area of greenhouse grown *Cannabis* in legal US states is already about the same as fruits & vegetables. While greenhouse grown *Cannabis* in Canada is less than 10% of the fruits & vegetables harvested area, its high value makes it an important crop. Other value crops such as salad greens (lettuce and microgreens) and strawberries account for less than 2% of the total US and Canadian fruits & vegetables greenhouse space.



Greenhouse gross profit typically matters more than revenue. **There are three components that affect greenhouse profits: 1. price fluctuations of the crops produced; 2. cost structure to produce; and 3. plant yield productivity.**

Sample: 1 million square foot US or Canadian greenhouse – Revenue and Gross Profit using 2018 values.

USD \$	Tomatoes	Peppers	Cucumber	Cannabis
Revenue	\$6,500,000	\$6,000,000	\$7,500,000	\$200,000,000
COGS	\$5,725,000	\$5,700,000	\$6,800,000	\$100,000,000
Gross Profit	\$775,000	\$300,000	\$700,000	\$100,000,000
Margin (%)	(12%)	(5%)	(9%)	(50%)

Source: agr.gc.ca and agric.gov.ab.ca; cannabis average yield of 100 grams/sq ft and price of \$2/gram with production cost of \$1/gram.

Gross Profit Margins based on Alberta Agriculture Greenhouse Economic Report (2018 and 2012).

Since 2018, greenhouse grown fruits & vegetables pricing has risen 5%-10% per year (*OMAFRA estimate*) so the highest yielding growers are generating closer to \$12-\$14/sq. ft. Most greenhouse fruits & vegetable producers earn normalized gross profit margins of 5%-20%, with the highest yielding greenhouses generating up to 30%-40% gross margin.

To date, *Cannabis* producers typically generate up to 50% gross profit margins but analysts forecast that average to materially shrink as the *Cannabis* market matures

with more competition, increasing supply and basic strains becoming commoditized.

How can greenhouse growers increase profits when price fluctuations cannot be relied upon and cost structures are generally set?

Answer: Low variable and fixed cost productivity improvements.

There are various new agriculture technologies, new nutrients and new plant disease prevention products that can increase plant yields. However, increased profitability levels vary. A grower's goal is to achieve the maximum gross profit possible with the least fixed and variable cost increases. For fixed costs, usually an investment payback of 2-years is considered a high return on investment for greenhouse owners.



CO2 Delivery Solutions™ is one of the new agriculture technologies that supports the ideal.

CO2 Delivery Solutions™ achieves all four of the ideal scenario factors: 1. yield increases of up to 30%; 2. extremely low operating costs; 3. fast investment payback; and 4. proven science at commercial scale.

What impact could CO2 Delivery Solutions™ have on greenhouse growers' profitability? Up to DOUBLING of GROSS PROFITS.

Example: 1 million square foot greenhouse – Revenue & Gross Profit Table with CO2 Delivery Solutions™.

USD \$	Tomatoes	Peppers	Cucumber	Cannabis
Revenue (+10%)*	\$7,150,000	\$6,600,000	\$8,250,000	\$220,000,000
COGS**	\$5,775,000	\$5,750,000	\$6,850,000	\$100,050,000
Gross Profit Margin (%)	\$1,375,000 (19%)	\$850,000 (13%)	\$1,400,000 (17%)	\$119,950,000 (55%)
Profit Increase	\$600,000 (77% increase)	\$550,000 (180% increase)	\$700,000 (100% increase)	\$19,950,000 (20% increase)

* assumes minimum 20% increase in production. Both lab and commercial scale greenhouse results have shown between 20%-30% increases.

** CO2 Delivery Solutions™ operating costs are approximately \$0.05/1sq ft/year (\$0.04 for CO2 and \$0.01 for energy). \$50,000 for 1M sq ft.

As the above shows, a 10% yield increase using CO2 Delivery Solutions™ can DOUBLE the GROSS PROFITS of greenhouse fruits & vegetables growers. As Cannabis prices continue to fall, the percentage impact of CO2 Delivery Solutions™ on greenhouse Cannabis gross profits will become even more pronounced.

How CO2 Delivery Solutions™ works.

CO2 Delivery Solutions™ first dissolves CO₂ gas into water creating a saturated CO₂ solution. The saturated CO₂ solution is then directly misted onto the plant's leaves creating a microfilm on the leaf's surface. The microfilm isolates the leaf from the atmosphere creating a diffusion gradient which enables the CO₂ molecules in solution to diffuse into the leaf through the entire leaf surface. The process is irrespective of the stomata which normally takes CO₂ from the air.

Since the technology delivers CO₂ to the plant directly through misting and creation of the CO₂ solution microfilm and not through the air and leaf stomata, greenhouses that vent heat can utilize the technology to deliver more CO₂ to their plants without worrying about CO₂ gas in the air escaping through the vents. **CO2**

Delivery Solutions™ has been proven on numerous plants from lab to commercial scale greenhouse to increase yields by up to 30%, while using less than 5% of the CO₂ gas required to maintain atmospheric CO₂ levels of >800 ppm and extremely low power consumption.

CO₂ is a limiting factor for optimizing growth in nearly all greenhouses in the US and Canada, whether located in warm climates with continual venting, or in colder climates where venting occurs through the warmer months from spring through fall. Numerous studies show that increasing CO₂ availability year-round to plants above that available in ambient air conditions of 400 ppm can increase yields by up to 30%. However, for those greenhouses that continually or periodically vent, increasing CO₂ levels in the grow area atmosphere to 800-1200 ppm is not feasible. Even greenhouses that add CO₂ to the atmosphere while venting are only able to achieve 400-500 ppm as most of the added CO₂ escapes through venting. While some of the added CO₂ gas may be utilized by the plants, much of the potential yield increases are not realized during venting.

If growers wanted to double their operating profits, one option is to double their greenhouse footprint. The cost of land, building, machinery, equipment, planting etc. amounts to up to \$10/sq. ft. (*agric.gov.ab.ca*). Even with gross profits of \$1-\$2/sq. ft., the capital investment payback will be 5-10 years. **Or, integrate CO₂ Delivery Solutions™ in their existing greenhouses to double their profits, reduce total unit production costs and lower their carbon footprint - with an investment payback of as fast as 1 year!**