

CANNABIS INTELLIGENCE BRIEFING

Cultivation: Capitalizing on a Tripling of Legal Demand



Executive Summary

Cultivation: Capitalizing on a Tripling of Legal Demand

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**Our research suggests that the legal market
of 2021 will consume about five million
pounds of flower, still only one quarter of the
overall North American cannabis crop**

Letter From the Editor

The legal cannabis cultivation business is reminiscent of the mid-1990s Internet: a formerly underground phenomenon bursting into the mainstream, drawing much press and an enormous influx of capital despite little certainty about its future direction. Valuation metrics seem aggressive, to put it mildly, as much for the publicly traded Canadian licensed producers today as they did for Google and Amazon at their initial public offerings 20 years ago. Investors didn't care. Sure, change was coming, but the upside was clearly enormous and the window of opportunity was thought narrow.

That's why, despite the enormous range of numbers our research with growers turned up, and the even wider range of opinions about the future direction of those numbers, we've ventured in this report to quantify some key metrics cultivators and their investors need: from the overall size of market demand for raw flower on a state-by-state basis, to start-up costs, revenue and operating costs for typical indoor, outdoor and greenhouse grows.

In all those models, we've aimed to be conservative to avoid overstating an upside that, like the Internet's, could well outstrip even the most bullish assumptions of the industry's early days. Hence, many growers are outperforming the typical operations we've modeled by wide margins.

Plus, there is really no such things as a "typical" operation today. A greenhouse grow today could be as simple as hoop houses with tarps, or as sophisticated as tem-

perature-controlled Dutch greenhouses with automatic light-deprivation systems. On top of that, the flood of capital is radically increasing both the size (in square feet) and efficiency (as measured by annual grams per square foot) of grow operations.

That's going to accelerate some changes—the transition from outdoor growing to indoor, from labor intensive-ness to technology intensiveness. It will be wrenching for many in the industry, but generally a great thing for consumers as prices come down and quality, consistency and purity go up. And just like ubiquitous access and enormous consumer choice were good for Internet companies that survived the 1990s, happy consumers will ultimately will be a good thing for the cannabis industry.



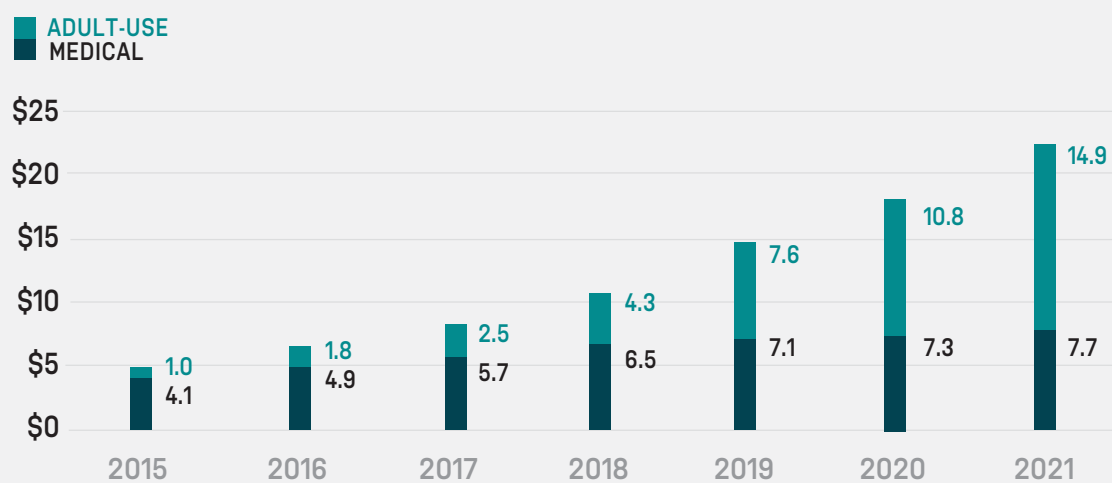
Tom Adams
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Cultivation: Capitalizing on a Tripling of Legal Demand

The art and science of cannabis cultivation have rapidly evolved since North Americans and Europeans started growing their own in the 1970s. With the advent of adult-use legalization in 2014, the business of cultivating cannabis is now changing quickly too. Some of those changes are regulator-driven, but most are simply business decisions made to capitalize on a market that Arcview Market Research estimates will grow from \$6.7 billion in consumer spending in 2016 to \$22.6 billion in 2021 (see graph).

The amount of cannabis that cultivators will need to grow to feed the demand for flower, concentrates, and edibles this spending represents will grow at a 23% compound annual growth rate (CAGR), from 1.7 million pounds in 2016 to 4.8 million pounds by 2021. That is a slower growth rate than consumer spending on cannabis because concentrates and edibles are projected to continue to grow as a share of the legal cannabis market. Both of those product categories utilize oil extract-

North American Legal Medical and Adult-Use Cannabis Spending (In Billions)



Source: Cannabis Intelligence Briefing

ed in part from trim left over after flower have been processed for sale. Although that's a great thing for the profitability of both growers and processors, it does put a brake on flower-demand growth.

The major question facing the industry on the cultivation front is how to grow? Cannabis was likely one of the first plants purposefully cultivated by humans as they settled down in agricultural communities 10,000 years ago, and it has thrived in outdoor fields ever since.

But prohibition forced home-growers of the '70s increasingly indoors, and even in pioneering commercial growing regions like California's Emerald Triangle (Humboldt, Mendocino, and Trinity counties) much of the growing now goes on within four walls—either in fully enclosed indoor facilities with only artificial light sources, or in mixed-light greenhouses. As outlined in later chapters, that brings many advantages to growers in terms of environmental control, uniformity of output, and product quality, but at higher costs, especially in regions with high energy rates (see table). It has also proven to be a challenge, as state regulators now get involved with legalization, to produce cannabis indoors that is

pesticide-free enough to pass new rigorous testing standards.

Traditional outdoor growing, especially now that legalization holds out the promise of being able to move out of rugged mountainous terrain and into traditional agricultural fields, will likely always be the cheapest way to grow cannabis in large volumes, and that could prove the decisive point as prices inevitably come down. But even before the point many years post-prohibition that cannabis finally costs what other legal, high-end crops can command, there will probably be a role for organically grown, terroir-rich flower with a story to be told to discerning connoisseurs.

Adult-use revenue is expected to surpass medical revenue in 2019 and reach almost twice its size in 2021 (\$14.9 billion vs. \$7.7 billion)

The decision on how to grow is determined by a myriad of variables including geography, weather, regulatory environments, security, and, most importantly, capital. Start-up costs vary for all three types of cultivation, but typically will be lowest for outdoor cultivation because of the absence of the need to either renovate or build out a warehouse or greenhouse. The environmental control offered by indoor cultivation allows for the most harvests per year, but greenhouse operations also offer multiple harvests per year, depending on the sophistication of the operation.

In consultation with a number of growers, investors, and cultivation-support companies, we developed for this report both start-up and operating financial models of modest-sized grows of the three types. Revenue per square foot is a function of the amount of cannabis annually harvested and the price of wholesale cannabis, which is generally highest for indoor and lowest for outdoor. Currently, indoor cultivation

boasts the highest revenue per square foot because of healthy wholesale prices and plentiful annual harvests. Indoor and greenhouse operations take similar amounts of time to pay back start-up costs, with outdoor operations taking the longest, generally due to being limited to one annual harvest.

We limited the size of the theoretical grows in our models to make them useful to growers at all levels, even those limited by regulation or market-size potential. There are substantial economies of scale available at most levels of the grow operation that generally improve all the various measures of success, from revenue-per-square-foot to operating margins, as growers scale up their plans—on the drawing boards these days are facilities with canopies of one million square feet and more.

The business changes coming to cannabis cultivation go well beyond scale, however. From seed to

Comparison of Cultivation Options

	INDOOR	OUTDOOR	GREENHOUSE
Typical Canopy in Square Feet	10,000	50,000	25,000
Typical Start-Up Costs (000)	\$750	\$1,250	\$500
Harvests per Year	4	1	3
Pounds Harvested per Year	889	833	2,143
Price per Pound	\$1,800	\$1,200	\$1,400
Typical Revenue/Square Feet	\$160	\$20	\$120
Revenue (000)	\$1,600	\$1,000	\$3,000
Utilities % of Revenue	23%	11%	18%
Typical Operating Margin	22%	17%	21%
Typical Net Profit (000)	\$144	\$57	\$265
Typical Years to Pay Back	2.1	2.9	2.0

Source: Cannabis Intelligence Briefing. Note: This does not include production/processing labs.

sale there are issues that cannabis growers are just starting to grapple with. At the beginning of the process, the simple act of putting a seed in the ground is being replaced by high-tech processes that often involve neither seed nor ground, but clones and hydroponic tanks. At the sales end of the pipeline, the transition away from a 100% flower-sales business toward concentrates and edibles is proving both a challenge and, conceivably, a key opportunity for growers.

Perhaps the biggest new challenge facing growers is testing, the requirement from most state governments that all cannabis flower be proven safe for human consumption before entering the distribution pipeline. We couldn't be further from the late-1970s when the federal government provided Mexico with helicopters to spray the herbicide paraquat on cannabis fields in an eradication effort, with an implicit "serves them right" attitude toward potential health risks to US consumers. In contrast, new governmental pesticide and heavy-metal limits instituted in Oregon in October 2016 virtually shut the market down.

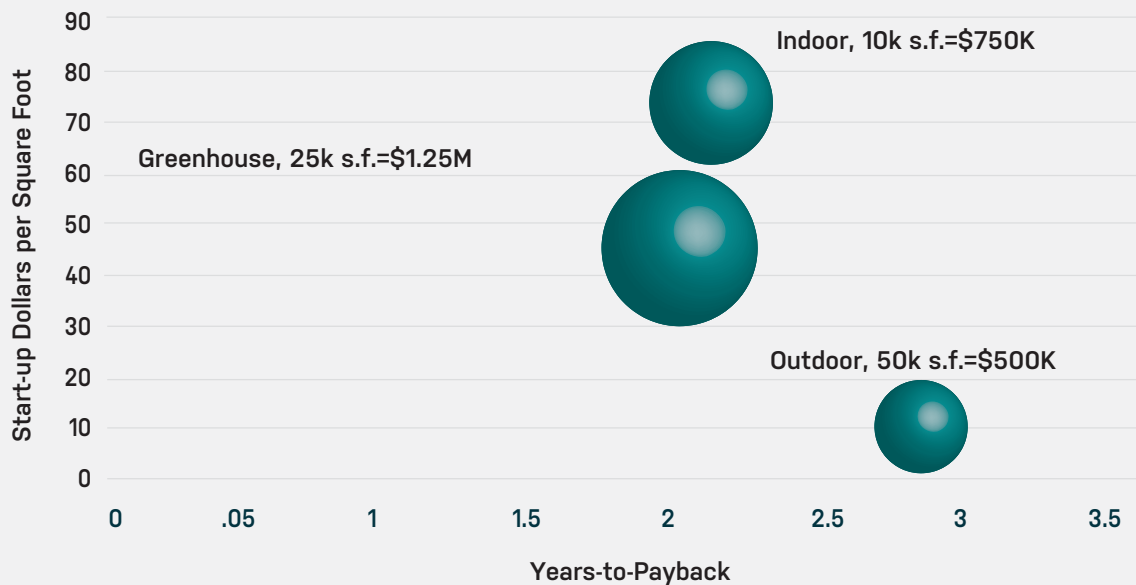
Hence regulators have put growers in a Catch-22 situation: from an overabundance of concern about security and neighborhood impacts they are requiring that cannabis be grown indoors

or in greenhouses in many localities; but cannabis is proving challenging to grow in commercial quantities indoors without chemical protection from insect and fungal parasites.

According to the June 2017 "CalCannabis Cultivation Licensing: Draft Program Environmental Impact Report" from the California Department of Food and Agriculture (CDFA), over the past 30 years, as roughly 40% of the California crop that supplies the lion's share of the nation's illicit cannabis moved into warehouses and greenhouses, testing wasn't mandatory. But now, some states

Perhaps the biggest new challenge facing growers is testing, the requirement from most state governments that all cannabis flower be proven safe for human consumption before entering the distribution pipeline

Years-to-Payback on Start-Up Costs



Source: Cannabis Intelligence Briefing

or localities are requiring that all cannabis be grown indoors, and at this point growers are struggling to do so with acceptable chemical residuals.

Growers have their own reasons to prefer indoor growing, including the control it gives them over every aspect of the product they end up with. But most importantly, it allows them to generate on average three to five crops per year. Indoor operations are constantly improving efficiency, and some are achieving continuous productivity by starting new crops weekly. That means that, although start-up and operating costs are much higher than in outdoor growing (both in

overall terms and on a per-square-foot basis for a typical operation), yields are higher and, thus, payback on the investment comes quicker (see graph).

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These are very early days for the business of legally cultivating cannabis, and things are going to evolve quickly, and likely in unexpected ways, as the “illegality premium” that has long gone to those willing to operate in the illicit market goes away. That will be a decades-long process that will begin in our five-year forecast window, during which only one third of the market (\$23 billion out of \$69 billion in North America by 2021) converts into legal channels--barring a major acceleration in the pace of legalization.

The experience so far in smaller states like Colorado, Washington, and Oregon suggests there are major opportunities available even as prices come down, and not only in enormous markets that are already legalizing adult use like California and Canada. Large medical-only states like Florida and New York are tightly controlling the competition licensed growers will face. But there are key opportunities in smaller states on their way to adult-use legalization like Massachusetts, and those that have recently implemented adult-use legalization like Nevada.

Supplying growers with agricultural inputs, business and professional services, and hardware and software, is already attracting companies from many fields. Adding processing capa-

bility to their grow operations allows cultivators to add value to the product and differentiate themselves. Some regions will be able to develop substantial cannabis tourism operations, while others will be better suited to the mass production of generic flower and hemp raw materials. It is not at all clear yet what changes will be wrought by the development of whole new applications for cannabis by pharmacologists and industrial plant scientists. And when federal prohibition finally does end, the whole industry will be transformed again by interstate commerce and eventually by global trade.

There is no need, however, to look that far ahead to see some major investment opportunities available in the business of cultivating cannabis.

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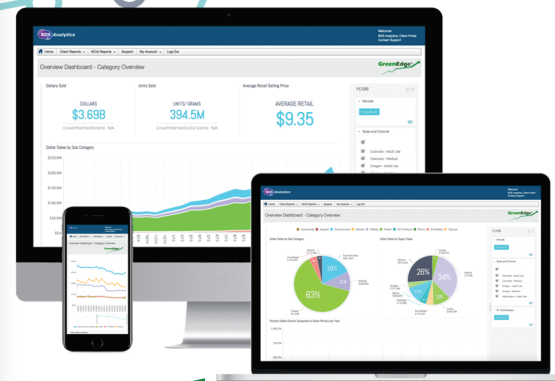
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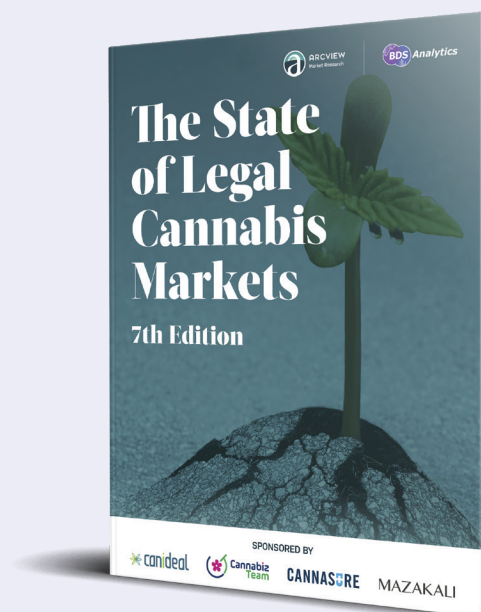
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