A COST ANALYSIS OF KIS ORGANICS SOIL OVER A 3 YEAR PERIOD

KIS ORGANICS

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10.03.2018

Abstract: There currently exists many different methodologies for growing cannabis in controlled environments[1]. Many of the current methods involving hydroponic cultivation have a large carbon footprint and negative environmental impact due to the use of fossil fuels. These methodologies only allow for the media to be used one or two times before being disposed of, which contributes to leaching of phosphates and other nutrients into our groundwater. An additional factor with cannabis cultivation is cost of production. The current market in WA and OR has driven the value of cannabis to record lows, resulting in many growers going bankrupt.[2] It is increasingly important to find ways to cut costs while maintaining a high quality product for the retail market. This paper is an attempt to show the affordability of living soil methodologies in regards to cost and yield for commercial cultivators of cannabis.

Methodology:

The method of cultivation was in raised beds in flowering rooms with a minimum of 10” of soil depth and a maximum of 18”. A 4'x 8’ bed for example, holds 1 yard of soil. This allows for optimal nutrient exchange between the media and plant and also offers greater buffering capacity for any nutrient imbalances or watering issues that may occur over the life of the plant.

Rolling beds may be used to maximize space efficiency and energy output.

The information below is based on a prospectus of:

5 crops per year = 10.4 weeks (73 days) in a cycle.

A 1,000 square feet building at 71% space use efficiency = 710 square feet of canopy.
1 cubic yard of soil covers 32 square feet* = 22.2 yards of soil

The initial cost of soil is higher than more traditional media options but it contains the nutrients and substrate for the cycle and allow for the soil to be re-used in successive cycles at a much lower cost.

KIS Organics Commercial Growers Mix Costs[3]

1,000 Square Foot Building

Cycle	Year 1 Cost per Yard	Year 2 Cost per Yard	Year 3 Cost per Yard
1	$280	$50	$50
2	$50	$50	$50
3	$50	$50	$50
4	$50	$50	$50
5	$50	$50	$50
Annual Average Cost per Cycle per Yard	$96	$50	$50
Total Annual Cost of Media and Nutrients	$10,656	$4,437	$4,437

A 10,000 square feet building at 71% space use efficiency = 7100 square feet of canopy. 1 cubic yard of soil covers 32 square feet* = 222 yards of soil

10,000 Square Foot Building

Cycle	Year 1 Cost per Yard	Year 2 Cost per Yard	Year 3 Cost per Yard
1	$225	$44	$44
2	$44	$44	$44
3	$44	$44	$44
4	$44	$44	$44
5	$44	$44	$44
Annual Average Cost per Cycle per Yard	$80.20	$44	$44
Total Annual Cost of Media and Nutrients	$89,022	$48,840	$48,840

For successive cycles the following is added per yard of soil:
1 cubic foot of compost or earthworm castings
1/3 - 1/4 large KIS Organics Nutrient Pack
1/4-1/2 cubic foot of aeration amendments (perlite, pumice, lava rock, etc…)

**Less soil may be needed as 20-30% of canopy will be vegetative plants in smaller pots. More soil may be needed if space use efficiency is increased via rolling tables like the photo below.*

YIELDS:

In a trial from 2017, the following yields were reported on the first cycle in KIS Organics Biochar Soil.[4] White paper available upon request.

Cultivar	lbs. per 4'x4' area	grams per square foot
Gorilla Glue #4	2.76 lbs.	78 grams
Gorilla Glue #4	3.22 lbs.	91 grams
Cookies and Cream	1.95 lbs.	55 grams
Total Averages Across All Cultivars	2.64 lbs.	74.66 grams

It should be noted that yield can vary considerably based on genetics and environmental conditions. Media and nutrients typically get the blame/credit for crop health and yield, however improper watering, lighting, CO2 levels, pruning, and other environmental conditions play a huge role as well.

We believe grams per square foot to be the best metric to evaluate yield when comparing different methodologies.

COST OF GOODS FOR MEDIA AND NUTRIENTS BASED ON YIELD

1,000 square foot building

Cycle Cost per Gram	40 grams per square foot	60 grams per square foot	80 grams per square foot
1	$0.22	$0.15	$0.11
2	$0.04	$0.03	$0.02
3	$0.04	$0.03	$0.02
4	$0.04	$0.03	$0.02
5	$0.04	$0.03	$0.02
Average Annual Cost per gram	$0.08	$0.05	$0.04
Average Annual Cost per lb.	**$32.47**	**$22.70**	**$18.16**
2nd year Annual Cost per gram	$0.04	$0.03	$0.02
2nd year Average Annual Cost per lb.	**$18.16**	**$13.62**	**$9.08**

10,000 square ft building

Cycle	40 grams per square foot	60 grams per square foot	80 grams per square foot
1	$0.18	$0.12	$0.09
2	$0.04	$0.03	$0.02
3	$0.04	$0.03	$0.02
4	$0.04	$0.03	$0.02
5	$0.04	$0.03	$0.02
Average Annual Cost per gram	$0.07	$0.05	$0.04
Average Annual Cost per lb.	**$28.83**	**$19.22**	**$14.42**
2nd year Annual Cost per gram	$0.04	$0.03	$0.02
2nd year Average Annual Cost per lb.	**$18.16**	**$13.62**	**$9.08**

Soil Testing:

Soil testing is recommend as part of any good soil and nutrient program. This allows for us to make adjustments based on any noted deficiencies or excesses and determine any limiting factors for growth. The recommended tests below range from $25-60 and testing should be done in the last two to three weeks of flowering to allow for adjustments for the following cycle.

We used three types of soil tests to evaluate the nutrient and mineral levels in the media. The Meilich III test and saturated paste test from Logan Laboratories and a Soil Savvy (artificial resin) test from UniBest. The Meilich III test is an acid extraction that is helpful in determining what nutrients and minerals are in the media but it does not show what is currently available for uptake for the plant. The Saturated Paste Tests and Soil Savvy test are two different testing methodologies designed to show what is currently available for plant uptake.

Sample Location			Biochar
Sample ID			Soil
Lab Number			85
Sample Depth in inches			6
Total Exchange Capacity (M. E.)			13.46
pH of Soil Sample			7.6
Organic Matter, Percent			33.33
ANIONS	SULFUR:	p.p.m.	427
	Mehlich III Phosphorous:	ppm	218
EXCHANGEABLE CATIONS	CALCIUM: ppm	Desired Value Value Found Deficit	1830 2012
	MAGNESIUM: ppm	Desired Value Value Found Deficit	193 169 -24
	POTASSIUM: ppm	Desired Value Value Found Deficit	210 412
	SODIUM:	ppm	97
BASE SATURATION %	Calcium (60 to 70%)		74.75
	Magnesium (10 to 20%)		10.46
	Potassium (2 to 5%)		7.85
	Sodium (.5 to 3%)		3.14
	Other Bases (Variable)		3.80
	Exchangable Hydrogen (10 to 15%)		0.00
TRACE ELEMENTS	Boron (p.p.m.)		0.54
	Iron (p.p.m.)		122
	Manganese (p.p.m.)		23
	Copper (p.p.m.)		0.84
	Zinc (p.p.m.)		6
	Aluminum (p.p.m.)		125
OTHER	Media Weight %		23.5

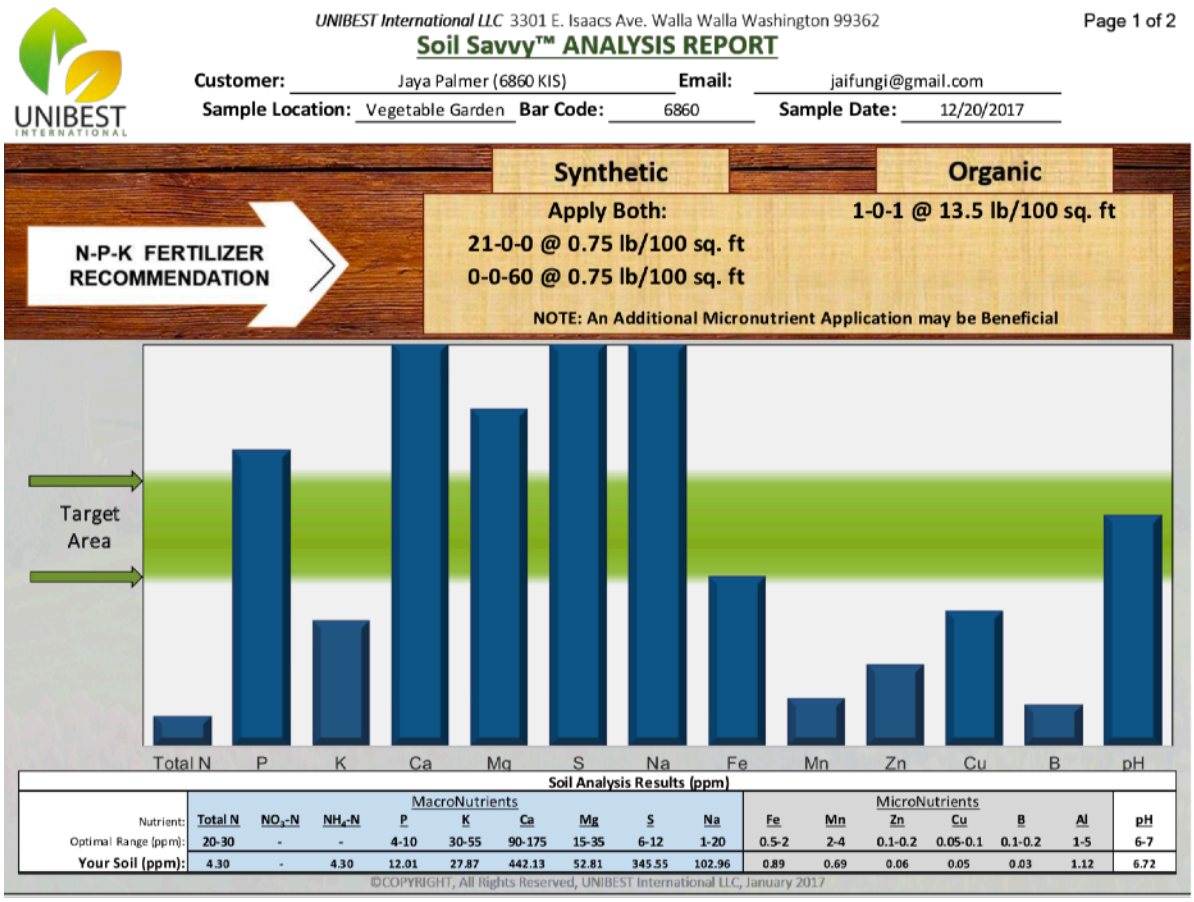
Saturated Paste Report

Job Name: Jaya Palmer — Date: 1/5/2018

Company: Jaya Palmer — Submitted By:

			S2S	KIS	Destiny		
Sample Location							
Sample ID							
Lab Number			114371	114372	114373		
Water Used			DI	DI	DI		
pH			5.6	7.5	6.8		
Soluble Salts		ppm	2,217	982	662		
Chloride (Cl)		ppm	456	322	193		
Bicarbonate (HCO3)		ppm	29	102	49		
ANIONS	SULFUR	ppm	298	203.3	142.5		
	PHOSPHORUS	ppm	11.8	1.12	2.03		
SOLUBLE CATIONS	CALCIUM	ppm	471.60	188.30	78.28		
		meq/l	23.58	9.42	3.91		
	MAGNESIUM	ppm	59.06	29.58	20.38		
		meq/l	4.92	2.47	1.70		
	POTASSIUM:	ppm	119.60	22.12	108.00		
		meq/l	3.11	0.57	2.81		
	SODIUM	ppm	69.78	66.86	44.26		
		meq/l	3.03	2.91	1.92		
PERCENT	Calcium		68.07	61.29	37.85		
	Magnesium		14.21	16.05	16.42		
	Potassium		8.97	3.74	27.12		
	Sodium		8.76	18.92	18.61		
TRACE ELEMENTS	Boron (p.p.m.)		0.25	0.2	0.46		
	Iron (p.p.m.)		0.19	0.15	0.24		
	Manganese (p.p.m.)		0.28	0.02	0.02		
	Copper (p.p.m.)		< 0.02	< 0.02	0.02		
	Zinc (p.p.m.)		0.23	0.03	< 0.02		
	Aluminum (p.p.m.)		1.04	0.77	0.64		
OTHER							

Logan Labs, LLC



Discussion:

Traditional methods carry the additional labor cost of removing the soil from the facility and purchasing new soil, as well as a disposal cost of used media. These costs need to be figured into the cost of production and labor is typically one of the largest variable overhead costs in a commercial facility.

With KIS Organics soils, we have had growers using the same soil for over 5 years following the methodology above. This allows for a lower cost of production over time as well as the added benefits of being organic, more sustainable, and producing a high quality flower. We believe that incorporating agricultural principles in creating a fertile living soil in an indoor environment allows us to maximize crop quality and efficiency on a commercial scale. Numerous awards have been won in KIS Organics soils including 2015 NW Cannabis Cup Best Sativa, 2016 Dope Cup Best Hybrid Flower, 2017 Dope Cup Best Rosin and Best Hash, 2018 2nd Place Best Rosin. With an average annual cost ranging from $0.04 to $0.02 per gram, we believe this to be one of the most cost effective methods for indoor cultivation of cannabis available today.

Gold Leaf Gardens is an Award Winning Cannabis Producer in WA State that has been re-using KIS Organics soil for past 3 years.

[1] Estimated Cost of Production for Legalized Cannabis JONATHAN P. CAULKINS https://www.rand.org/content/dam/rand/pubs/working_papers/2010/RAND_WR764.pdf

[2] https://www.slyng.com/news/why-are-so-many-weed-farmers-going-out-of-business-411

[3] https://www.kisorganics.com/products/kis-organics-commercial-growers-mix

[4] A Comparison of Living Soil Methodologies in Relation to Plant Health and Yield in a Controlled Environment by Tad Hussey and Jaya Palmer