3-D Sketch video

https://www.youtube.com/watch?v=OOoDiTtSGDM
Composting in the Cannabis Industry

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WHY NOW?

- Leglisation of marijuana
- Banning of organic waste
  - Québec 2020
  - Imminent
  - INCREASING COSTS OF COLLECTION AND DISPOSAL
- Health Canada Regulations
  - ”Health Canada faces a 'massively steep learning curve' in regulating the nascent legal industry” - Solomon Israel, CBC News, April 2017
- **ACMPR** Access to Cannabis for Medical Purposes Regulations (**ACMPR**)
Access to Cannabis for Medical Purposes Regulations (ACMPR)

- Since August 2016
- According to the interpretation in the ACMPR, ‘cannabis is considered to be destroyed when it is altered or denatured to such an extent that its consumption and propagation is rendered impossible or improbable.’
- The principal sections of concern:
  - Part 1, Division 1, Subdivision A, section 30: Commercial Production, Licenced Producers, Authorized activities and General obligations, ‘Destruction’
  - Part 1, Division 5, Section 165: Commercial production, Record keeping by licenced producers, ‘Destroyed cannabis’
WHO WE ARE

- A PARTNER FOR LP’s THAT WISH TO INSTALL COMPOSTING SYSTEMS FOR TREATING CANNABIS RESIDUES
- WE OFFER COMPOSTING SYSTEMS....not just a composter
- IN-VESEL COMPOST CONSULTANTS SINCE 2005
  - MANUFACTURER SINCE 2014
- ON-FARM MORTALITIES
  - Increase biosecurity
- INSTITUTIONAL and COMMERCIAL IN-SITU COMPOSTING
  - Universities, Grocery stores
A modular system for on-site composting that adapts to your needs.

Get instant technical quotes.

Select the following fields depending on your industry:

- **Sector**
  - Greenhouses

- **Number of pounds per week**
  - 0 to 2000 lbs (0 to 907 kg)

Get a technical quote

**Latest posts**

- **Legalized cannabis cultivation can boost waste industry revenue**

- **Congradulation to Lufa Farms**
  - By choosing on-site composting for their organic agriculture, Lufa Farms is leading the way in sustainable agriculture.

In greenhouses, and particularly those housing cannabis operations, composting offers several benefits:

- Improve greenhouse production
- Heat recovery from the composter for use in the greenhouse;
- Disposal of diseased plants through composting;
- Possible partnership with neighbors, allowing for the implementation of a resource pool for carbon or nitrogen feedstocks;
- Rare opportunities for surplus compost.

**GREENHOUSES & CANNABIS**
Various options: Organic Waste Disposal

- **Landfilling:** GHG’s (more potent methane and nitrous oxide) and leachate, Banning of organic waste, transportation

- **Incinerating:** fine particulates, high energy consumption for combustion when humid, non-optimal incineration temperatures, less socially-acceptable, costly

- **Stockpiling:** may not lead to degradation, **not satisfying regulatory criteria.**

- **Dilution**

- **Biomethanisation**

- **COMPOSTING » » » »**

*(Williamson & Williamson 2010).*
What is Composting?

Composting: Composting is a managed process of bio-oxidation of a solid heterogeneous organic substrate including a thermophilic phase

- **AEROBIC PROCESS**
  - Oxygen for microbial activity
  - Manages, reduces, eliminates noxious odours
- **HUMIDITY** (around 60%)
  - Essential for efficient composting
- **NITROGEN**
  - Potentially necessary depending on C content
- **CARBON**
  - Structural Amendment
- **THERMOPHILIC PHASE**
  - 55°C and over for our purposes here
Benefits of composting
Benefits of composting

- Reduce waste collection costs
  - Volume reduction
- Ease of handling after treatment
- Conform to governmental regulations
  - i.e. banning of organic waste in landfills
- Produce a reusable product
  - Reused in soil-based operations - saving $$
  - Reuse in greenhouses
  - Potential sales
**SEEDS: Destruction**

Table 1. Estimated number of hours required to kill 90% of seeds (after Dahlquist et al., 2007).

<table>
<thead>
<tr>
<th>Species</th>
<th>Temperature (°F)</th>
<th>Time required to kill 90% of seeds (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>140</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>108</td>
</tr>
<tr>
<td>Annual sowthistle</td>
<td>&lt;1.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Barnyardgrass</td>
<td>&lt;1.0</td>
<td>5.4</td>
</tr>
<tr>
<td>London rocket</td>
<td>&lt;1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Common purslane</td>
<td>1.3</td>
<td>18.8</td>
</tr>
<tr>
<td>Black nightshade</td>
<td>2.9</td>
<td>62.0</td>
</tr>
<tr>
<td>Tumble pigweed</td>
<td>1.1</td>
<td>107.0</td>
</tr>
</tbody>
</table>

(Original values in °C were converted to °F using the formula: °F = (°C * 1.8) + 32)

**MOISTURE**

**TEMPERATURE**
PATHOGENS: Destruction / Denaturing

- HEAT generated during the active phase of composting has been found to be the most important factor affecting pathogen destruction
- microbial antagonism
- competition for nutrients / populations
- natural loss of viability of the pathogen with time

BACTERIAL ACTIVITY AND HEAT CHANGES THE ECOSYSTEM: DENATURES
Effect on cannabinoids? : DILUTION

- The THC content varies depending on the plant part:
  - 10-12% in pistillate flowers
  - 1-2% in leaves
  - 0.1-0.3% in stalks
  - < 0.03% in the roots.

  (UNODC Annual Drug Report, 2014)

- Destruction of active ingredients in cannabis is considered essential for safe handling of cannabis production waste.
Further treatment

- Despite the general suggestion of 3 days of thermal composting at 55°C for killing seeds, reducing pathogens and degrading cannabinoids, the *residency time* proposed within our in-vessel composter is higher i.e. a minimum of 5 to 7 days.
- But what are YOUR needs?
RESIDUES TO COMPOST
LEAVES / TRIMMINGS

- NITROGEN-RICH
- HUMIDITY
  - ‘To be determined’
  - Immediate vs stockpiled for compost recipe
- SECURE AREA
STEMS

- NOT ESSENTIAL TO COMPOST THEM
- STILL NEED TO BE DISPOSED OF
- C:N RATIO VARIABLE
  - Growth cycle time
  - Indoor vs Outdoor
  - Variable lignin content, younger stems
- CHIPPER SHREDDER
ROOTBALLS

- WITH OR WITHOUT COMPOSTABLE GROWING MEDIA
- NOT ESSENTIAL TO COMPOST, but disposal still necessary
- CARBON-RICH
  - Outer root cells more nitrogen rich
  - Compost to avoid re-planting
- HUMIDITY variable
- SHREDDER
Growing media

- Hydroponics
  - Coco-coir, peat, EZ Plug,....
- Soil or soil-like
  - Commercially prepared mixes that include coco-coir and peat
  - Organic cannabis
- Rockwool
  - Not compostable
Growing media - To consider

C:N RATIO / NUTRIENT RICH

- Coco coir: high C:N ratio (110:1).
  - High lignin content affects its decomposition time. The carbon is not readily available to micro-organisms.
  - May retain nitrogen from fertilisers, some fertilisers may affect bacterial populations
  - Provides aeration, balanced pH
  - NEEDS: Nitrogen, humidity, oxygen and time.

HUMIDITY
- Will retain humidity, affects composting process

PRE-TREATMENT
- Shredded with rootball
Growing media - Using other nitrogen sources or structural amendments

- Indoor operation
  - Pellets
- Outdoor operation
  - More space for curing piles
  - Different manures
BROME COMPOSTER
ADVANTAGES: BROME COMPOSTER

- LESS STRUCTURAL AMENDMENT REQUIRED
- AUTOMATIC AERATION
  - Rotations
  - Perforated plate
- INTERIOR OR EXTERIOR FACILITY
- VARIOUS SIZING and MODULAR
- CANNABIS CONTEXT
  - ALTERS AND DENATURES
    - Temperature, Humidity, Oxygen
  - CAN ACT AS A SECURE AREA
    - Doors can be locked
    - Outdoor installation may need a fence
- Dilution
  - BY ADDING STRUCTURAL AGENT OR AMENDMENT
  - ‘Finished’ compost may also be added to the material at the beginning of the process.
Heat

Micro-organisms

Gases ($\text{CO}_2$, $\text{H}_2\text{O}$, $\text{H}_2\text{S}$, $\text{CH}_4$, etc.)

Heat

Compost

(40-50% volume reduction)

O.Matter - Nitrogen - Carbon

$\text{H}_2\text{O}$ $\text{O}_2$

**Organic Materials**
- proteins
- amino acids
- lipids
- carbohydrates
- cellulose
- lignins

$+ O_2 \xrightarrow{\text{Micro-organisms}}$

**Humus or Compost**
- cellulose
- lignin
- minerals

$+ CO_2 + H_2O + NH_3 + \text{new cells} + \text{heat}$

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UNDERSTANDING YOUR NEEDS

We can guide you!
Ask the right questions; get the right answers

- WHAT will you be composting? How much?
  - Parts of the plant, rootballs, other, kg??
- HOW will you be managing what you wish to compost?
  - Logistics, equipment, receiving areas, secure areas/vaults
- WHEN will you be harvesting?
  - Growth cycle, amounts harvested per batch
- WHERE?
  - Indoors or outdoors
- WHY
- STORAGE / END-USE
HARVESTING SCHEDULE

- AFFECTS SIZING OF THE COMPOSTER

- QUESTIONS
  - Indoor, Outdoor, Greenhouse?
  - Growth-Cycle?
    - 3 month = 4 batches
  - Harvest timing per batch
    - E.g. 1/3 at a time
  - Number of grow rooms
OUR ROLE AS PARTNERS

We’ll guide you through the steps
List of composting materials

**General comments:** Currently waiting for approval from Health Canada to start construction in June 2016 for production starting in February 2019.

Facility: 50,000 square feet; 1700 grow lights @ 4 plants per light = 6800 plants

4 month growing cycle: 3 batches per year

Assumptions to be reviewed: Roots: 0.5 kg with some residual humidity. Stems: 0.2 kg (to be determined)

Currently exploring your options for growing media. Rockwool is not compostable, therefore rootballs surrounded by this media will not be able to be composted. Other options include coco coir and peat-based media, which can be treated.

Nitrogen source: Nitrogen source to be determined.

**STEMS:** 6800 x 0.2 kg (marked as 'plant residues' here) = 1360 kg per batch (x3 per year = 4080 kg)

**ROOTS:** 6800 x 0.5 kg assuming some leftover humidity = 3400 kg per batch (x3 per year = 10,200 kg)

'Per week' volumes below are based on: one batch / 17.3 weeks

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>QUANTITY PER WEEK</th>
<th>NOTES OR COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root balls</td>
<td>196.5 kg</td>
<td>• % of humidity un-known</td>
</tr>
<tr>
<td>Plant residues</td>
<td>78.6 kg</td>
<td>• No note available</td>
</tr>
<tr>
<td>Nitrogen source</td>
<td>786 kg</td>
<td>• Many types of nitrogen sources can be chosen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quantity estimated can change in every situation</td>
</tr>
</tbody>
</table>

**TOTAL:** 1061.10 kg
General comments: A BROME 516 is suitable for your needs. It will allow enough space to manage the volumes created every 4 months.

To denature and destroy cannabis residues Brome Compost thermophilic temperatures need to be above 55 degrees Celsius (131 Fahrenheit) to denature or destroy seeds and cannabinoids. This is determined by the composting recipe. Although composting standards only require 3 days at thermophilic temperatures to reduce pathogens and seeds, Brome Compost suggests a residency time of around 7 days to treat cannabis residues.

Carbon source: Root balls and stems. These also may have nitrogen depending on the age of the plant and the possibility of residual nitrogen fertilisers.

Nitrogen source: Composting requires a proper ratio of carbon to nitrogen for the process to be efficient. Cannabis residues can be higher in carbon, particularly woody stems and roots. In an indoor facility the concern for maintaining a more sterile environment and avoiding the introduction of pathogens is an ongoing concern, so the addition of certain externally-sourced nitrogen-feedstocks need to not increase this risk. Pellet and powder forms of nitrogen are a safe option: Here is a list of possible option for nitrogen-rich additions: Bone meal, Corn-gluten meal, Nitrogen-rich granular fertilizers, Urea, Alalfa pellets and, finally, coffee grounds (potentially free feedstock).

Theoretical weekly volume (hypothesis: 500kg per m²)

<table>
<thead>
<tr>
<th>CHOICE</th>
<th>PRODUCT</th>
<th>TOTAL CAPACITY M³</th>
<th>USEFUL CAPACITY M³</th>
<th>THEOREICAL RES. TIME (DAYS)</th>
<th>QTY PER BATCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Brome 516 (x1)</td>
<td>7</td>
<td>4.6</td>
<td>15.17</td>
<td>1.06</td>
</tr>
</tbody>
</table>
General comments: To be discussed further.

Number of days of introduction per week | 1 | No note available
Number of batch per day of introduction | 2 | No note available

Rolling totes

Link: http://www.brome-compost.com/products/bac-roulant/
Notes:
• Requires the use of a bin lift

Manually

Link:
Notes:
• No note available
Preprocessing

General comments: Chipping stems reduces their volume and improves the efficiency of the composting process.

Mixer 140

Link: http://www.bromecompost.com/products/e-melangeur/

Notes:
**Insulation**


**Notes:**
- for exterior use

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**Forced aeration with perforated plate**


**Notes:**
- Increase air control in the vessel
- Oxygen is an essential ingredient in composting
- Allows to increase the capacity of the composter
A VARIETY OF EQUIPMENT

- **CHIPPERS**
  - Stems, rootballs
  - Cardboard (Carbon-rich structural amendment)

- **MIXERS**
  - For larger volumes; increases composter capacity
  - Integrated scale facilitates recipe creation
  - Homogenises

- **CONVEYORS**
  - From Preprocessing equipment to composter
  - From composter to pile or storage

- **AERATION**

- **ODOUR MANAGEMENT**
  - Odour management plans
Composting Cannabis

- **Recipe management**
- **Pre-treatment**
  - Shredders (stems and rootballs) to break down materials into smaller particles
  - Mixers (For homogenizing, kickstarting the process)
- **Aeration**
  - Rotations
  - Forced aeration
  - Size of particles of structural amendment
  - Coco coir and peat too!
- **Thermophilic temperatures**
  - Efficient composting
  - Destruction of seeds and reduction/destruction of cannabinoids
- **Dilution**
  - Adding structural agent
  - ‘Finished’ compost may also be added to the material at the beginning of the process.
OTHER Services

- CREATION OF SOP’S
  - To help with permit requirements
  - Federal or municipal
- Training for Operators
  - On-site or online
- Web Calculator
  - Each operator has own password (Person-in-charge, ACMPR)
  - Facilitates recipe creation
  - Useful for reports
- 3D SKETCH
STORAGE AND CURING

- Collection for curing and spreading elsewhere
- Reduce carbon content and phytotoxicity
- Aerobic process
- Some soil-based LP’s wish to reduce the quantities of ready-made soil-mixes
REUSE

- Produce a reuseable product
  - Reused in soil-based operations - saving $$
  - Reuse in greenhouses
  - Potential sales
  - Organic production
QUESTIONS?

BROME Compost inc.

THANK YOU