PRESENTER:
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The Effect of Spent Coffee Grounds on Germination and Growth of Container Grown Specialty Crops

Composted SCG can be used as a partial peat replacement for Eggplants and

BACKGROUND: As coffee consumption increases, so does the amount of SCG, creating a waste management issue. Coffee consumption was about 9.3 billion kg in 2016 (McNutt and He, 2019). Spent Coffee grounds constitute 45-50% of the waste produced from coffee consumption, and often pose environmental hazards from runoff when put in landfills (Janissen et al., 2018).

The increase in demand has resulted in an explosion of large coffee beverage companies. One of the largest cold brew coffee companies in North America is in San Antonio, TX. In 2017, they produced 40 cubic yards of SCG a day (Figure 1), and project that amount to increase exponentially.

Using SCG as a media amendment would remove substantial amounts of waste from landfills and give growers another viable alternative to sphagnum peat moss.

Fig. 1: Dumpsters of SCG generated from cold-brew coffee production

The role of SCG as a soil amendment is promising. They out rank many other organic waste products in terms of chemical and physical suitability for agronomic and horticultural uses. Spent coffee grounds have large amounts of organic matter, high mineral content, suitable pH range of 5.6-6.8, and a low carbon to nitrogen ratio (Figure 2). By diverting SCG from landfills and using them as an addition to media in place of peatmoss, we are decreasing CO_2 immersions and creating sustainable practices and a circular economy.

Functional Properties	Spent Coffee Grounds	Canadian Sphagnum Peat Moss (professional grade)[a]
Water holding capacity (g/g water/dry sample)	5.73[d]	10 – 14
pH	5.6 – 6.8[c,d]	3.5 – 3.8
Organic Matter Content (%)	90.5[b]	98 – 99
Carbon:Nitrogen	20 – 25:1[b,c]	48 – 54:1

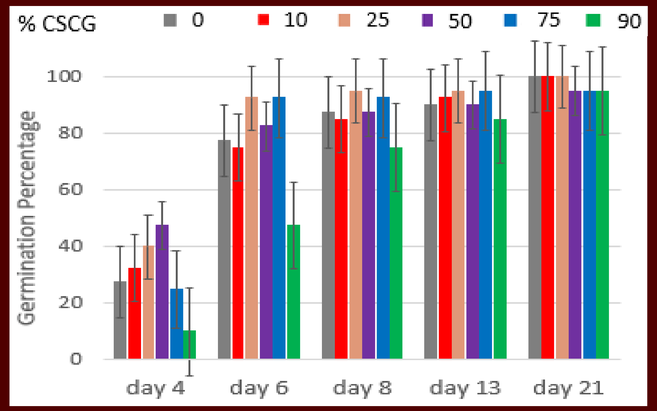
www.Theriault-hachey.com[a]; Stylianou et al., 2018[b]; Flores et al. 2020 (unpublished)[c]; Ballesteros et al. 2014[d]

Fig. 2: Functional properties of peat moss versus non-composted SCG

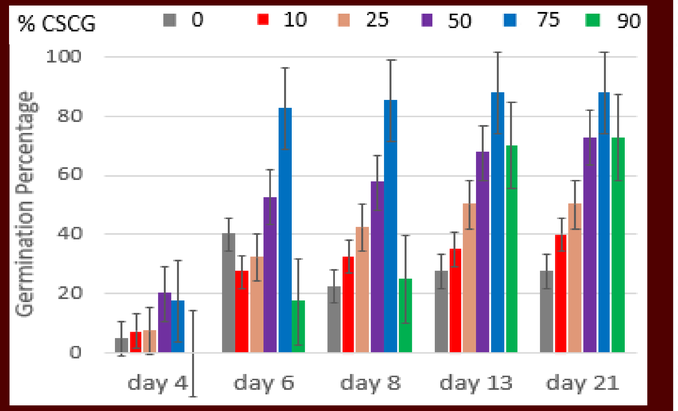
METHODS: This study was conducted at the Horticulture Teaching Research and Education greenhouses

- 2 Media types:
  - potting mix with non-composted SCG
  - potting mix with composted SCG
- 5 Ratios (v/v); 90:10, 75:25, 50:50, 25:75, 10:90, and the control 0 SCG
- 1 Fertilizer rate (15-5-25)
  - High 0.4 g/L (400 ppm)
- 5 Replicates/treatment growth experiment
- 40 seeds/treatment germination experiment
- Seeds started in seedling plugs

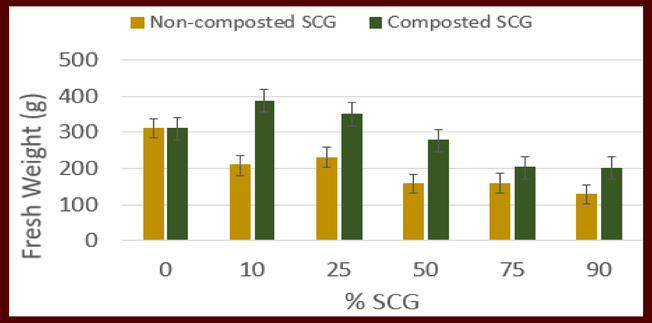
Pea germination was stimulated at 50% CSCG



Spinach germination was greatest at 75% CSCG



Biomass of eggplant was greatest in 10% CSCG



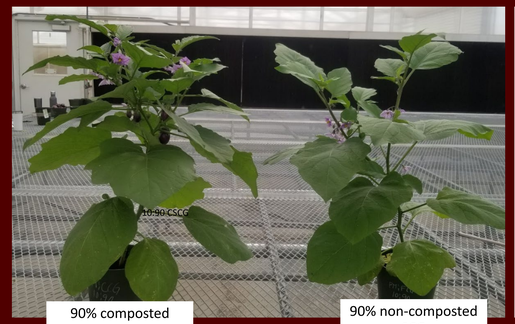
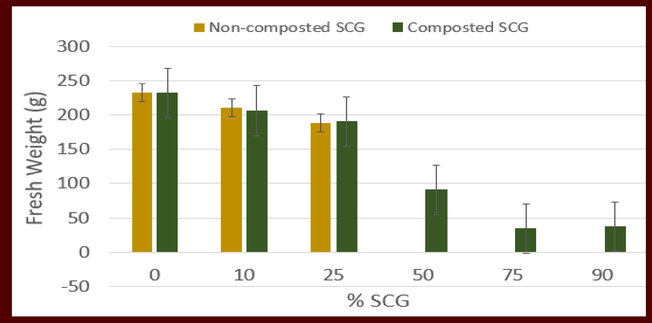


Fig. 3: Size and development difference in eggplants at 90% CSCG and non-CSCG. Fresh weight when grown in CSCG was greater than in peat alone or non-CSCG in as much as 50% CSCG.

Basil died in non-composted SCG >50%



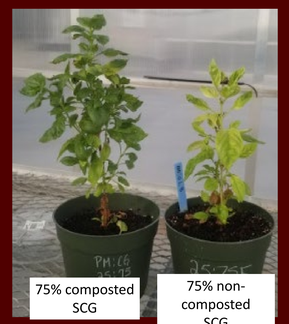


Fig. 4a: Size and development difference in basil at 75% CSCG and non-CSCG. Fresh weight was not significantly different until 50% SCG.

Fig. 4b: Tip death in basil at >25% non-CSCG.

GERMINATION RESULTS AND CONCLUSIONS

Peas: There were no significant differences among treatments at day 21. Day 4 emergence was significantly greater in 50:50 treatment than higher rates of CSCG.

Spinach: Germination percentage was significantly lower in control at day 21 compared to all other treatments. Day 6 emergence was significantly greater in 25:75 compared to all other treatments.

GROWTH RESULTS AND CONCLUSIONS

Eggplant: Eggplant fresh weight is significantly higher in CSCG than non-composted SCG across all treatments. Non-composted SCG reduced growth and stunted development in all treatments compared to CSCG.

Basil: There was no significant differences in fresh or dry weight in treatments < 50% SCG. Basil plant died in treatments > 50% SCG.

Table 1: Fresh and composted SCG are similar in their total N and inorganic N

	Fresh SCG	Composted SCG
% N	2.3	2.9
$NH_4^+ + NO_3^-$ (mg kg^{-1})	314.3	323.0
% P	0.1	0.1
% K	0.5	0.5
% Ca	0.2	0.2
% Mg	0.1	0.1
% Na	0.1	0.02
Zn (mg kg^{-1})	17.9	19.8
Fe (mg kg^{-1})	409.2	750.0
Cu (mg kg^{-1})	27.5	25.5
Mn (mg kg^{-1})	42.7	52.2
S (mg kg^{-1})	1574.6	1890.0
B (mg kg^{-1})	4.9	5.6
C:N	20:1	20:1
pH	5.5	5.3

FUTURE RESEARCH

- Data from this study suggest that longer timeframes should be examined for fully understanding N release dynamics from SCG.
- Evaluation of microbial communities and diversity in SCG-amended is needed.
- Characterization of the classes of compounds making up SCG should be examined.

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