Improving sustainability and nutritional properties of specialty crops using composted spent coffee grounds

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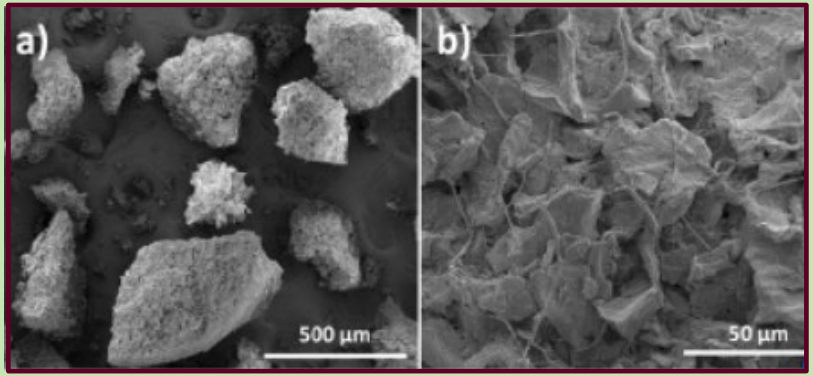
Spent Coffee Grounds: A valuable waste stream

- Constitute ~45% of coffee waste
- 1,000s of tons/year sent to landfills
- Often collected separately from other waste
- Rich source of organic matter and bioactive compounds

Physical Properties of SCG

- High water holding capacity
- High surface area-to-volume
- High porosity
- Good durability
- Rigid cellular structure

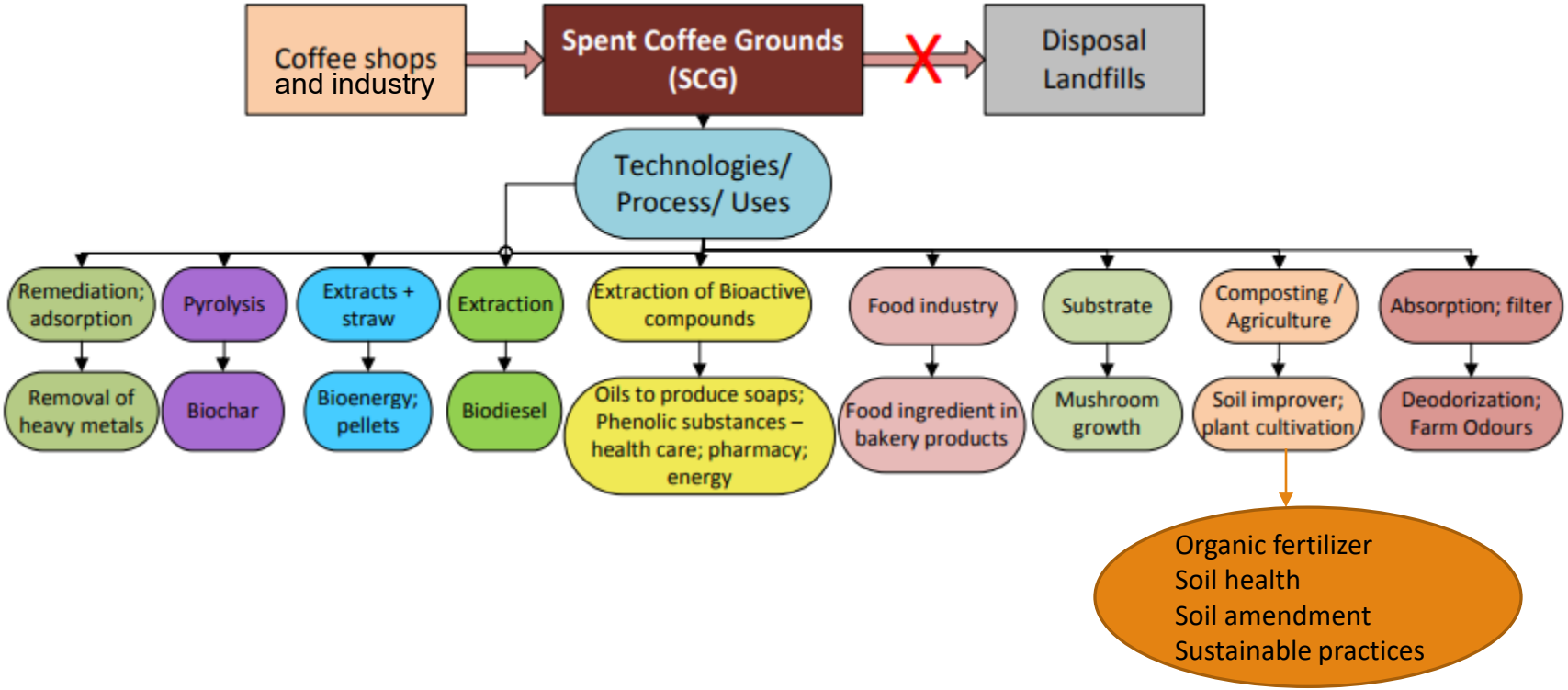


SEM Micrograph of SCG at 200 (a) and 2,000 (b) magnification (Ballesteros et al., 2014)

Chemical Composition of SCG

Chemical composition / Parameter	Content (wt%)	Chemical composition / Parameter	Content (wt%)
Cellulose	8.6-13.3	Arabinose	1.7
Hemicellulose	30-40	Galactose	13.8
Proteins	6.7-13.6	Mannose	21.2
Oil	10-20	Ashes	1.6
Lignin	25-33	Organic matter	90.5
Polyphenols	2.5	Nitrogen	2.3
Caffeine	0.02	Carbon/nitrogen (C/N ratio)	22/1

Stylianou et al., 2018. Converting environmental risks to benefits by using spent coffee grounds (SCG) as a valuable resource.



Stylianou et al., 2018

SCG as an Alternative to Peat

- 93% produced in the U.S. was sold for horticultural uses
- Price of peat continues to increase
- Weather patterns prevent harvesting
- Peatlands are major carbon sinks

www.indefenseofplants.com

Nutrient Analysis Report Comparing SCG, CSCG and Peat Moss

	N %	P %	K %	Ca %	Mg %	Na %	Zn ppm	Fe ppm	Cu ppm	Mn ppm	S ppm	B ppm
SCG	2.3	0.1	0.5	0.2	0.1	0.1	15.2	151	27	45	1445	11.5
CSCG	3.5	0.1	0.3	0.6	0.2	0.001	10.5	1473.7	30.6	66.7	2692.4	11.5
Peat Moss	0.8 - 1.0	0.01 - 0.03	0.01 - 0.2	0.1 - 0.25	0.1 - 0.2	–	–	–	–	–	–	–

	C:N	pH
SCG	20:1	5.6
CSCG	-	4.7
Peat Moss	48 – 54:1	3.5 – 3.8

Soil, water and forage testing lab, Texas A&M; www.Theriault-hachey.com

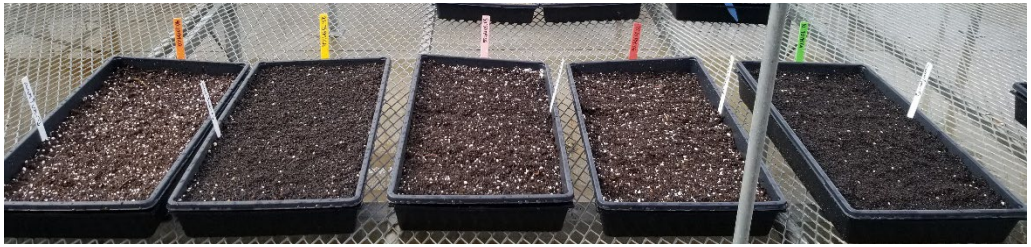
Research Objectives

- **Objective 1:** Develop research-based data to establish CSCG as a viable soil amendment and partial peat substitute for specialty crops (peppers and leafy greens).

- **Objective 2:** Investigate the ability of CSCG to enhance the nutritional properties of specialty crops (peppers and leafy greens)

Research Questions

- What is the effect of CSCG on seed germination?
- sugar snap peas and spinach



Potting mix:CSCG at 90:10, 75:25, 50:50, 25:75, 10:90

Sand:CSCG at 90:10, 75:25, 50:50, 25:75, 10:90

Sugar Snap Peas and Spinach Germination in CSCG

SUGAR SNAP PEAS

- Potting mix:CSCG and Sand:CSCG 95 – 100% germination in all treatments

SPINACH

- Potting mix:CSCG 95% germination in 75% CSCG
- Sand:CSCG 100% germination in 75% CSCG

Research Questions

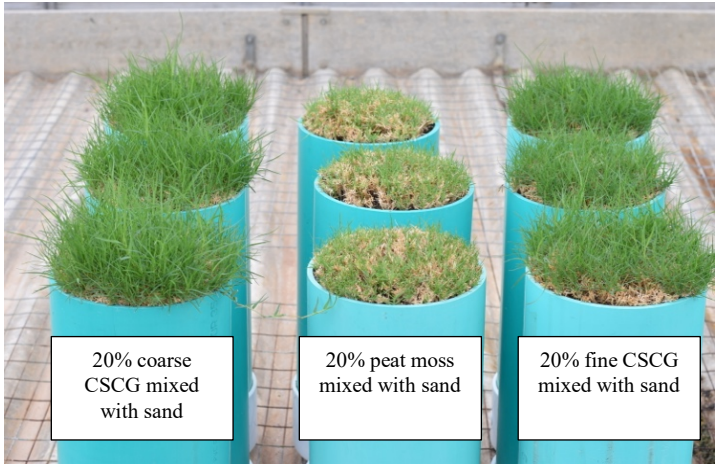
- How are the physical-chemical properties of the soil modified by the addition of CSCG?

Incubation experiment comparing release of inorganic Nitrogen over time.

CSCG Improve Soil Water Holding Capacity and/or Fertility

- 4 months after the last fertilization with ammonium sulfate
- Peat moss (middle) did not retain the nutrients or water as well as CSCG over time
- Basil and tomato grown in 40% CSCG showed similar vigor compared to fertilized (Ronga et al., 2016)

Turfgrass growing in sand amended with 20% CSCG (coarse and fine) compared to peat moss



Flores et al., 2018 (unpublished)

Research Questions

- What types, if any, of health-promoting compounds are stimulated by using CSCG as a soil amendment?

- Addition of SCG to growing medium can increase antioxidant and amino acid content and mineral nutrients
  - Lettuce grown in 15% SCG showed increases up to 90% and 72% in β-carotene and lutein, respectively (Cruz et al., 2012).
  - SCG contain high amounts of leucine and isoleucine (Campos-Vega et al., 2015)
  - Lettuce grown in 5% composted SCG increased potassium content by 40%, manganese by 30%, magnesium by 20%, and sodium by 10% (Cruz et al. 2014)

Thank you!!

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