Postharvest Storage Potential of Industrial Sweetpotato Roots and Culls

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Abstract

A year-round feedstock for biofuel production would be advantageous for Florida as a replacement crop for citrus groves lost to citrus greening. The CX-1 sweetpotato is a white-fleshed, high-starch cultivar specifically bred for ethanol production. The culls, defined as roots that have been damaged by disease or pests, could be used for energy recovery via anaerobic digestion. The objective of this research was to evaluate the postharvest storability of CX-1 roots and culls. Samples were prepared at harvest and six months after harvest and characterized for total solids (TS), volatile solids (VS), chemical oxygen demand (COD), starch, and methane potential (culls only). All analyses were conducted in triplicate, according to Standard Methods. Methane index potential (MIP) batch assays were conducted for 30 days at 35˚C, in triplicate. The starch content in the roots was conserved after six months of storage. The freshly harvested culls reached 100% of their theoretical methane yield, while the stored culls only reached 82%. The CX-1 roots are an ideal year-round feedstock for bioethanol production considering their high starch content and storability, and the culls are a valuable co-product that could be efficiently digested for methane production immediately following harvest.

Introduction

The citrus greening epidemic is leading to many fallow fields in the State of Florida. An industrial sweetpotato cultivar, CX-1, may be planted in these fields and harvested to produce carbon-neutral bioenergy. The roots of the CX-1 can be utilized for bioethanol production and the culls can be anaerobically digested to produce biogas[1]. This project focused on the effects of postharvest storage on the bioenergy potential of both roots and culls.

Industrial Cultivar: *CX-1*
- Higher Starch Content
- Total Solids: 21.2%
- Used to produce bioethanol

Table Cultivar: *Beauregard*
- Lower Starch Content
- Total Solids: 14.8%
- Used for Human Consumption

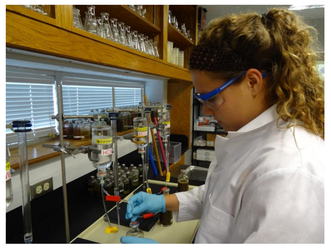
Roots vs. Culls

Objectives

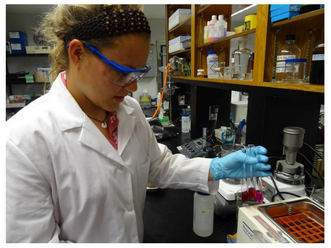
- Determine the methane potential of freshly harvested culls versus culls stored for six months via methane index potential assay.
- Determine the starch content of fresh roots versus roots stored for six months via total starch assay.

Methods

- **Methane Index Potential (MIP) Assay[2] (Culls Only):**
  - Batch assay in triplicates
  - Organic loading at 2 g COD per liter
  - Samples incubated at 35° C
  - Gas measurements recorded routinely over 30 days
- **Total Starch Assay (Roots and Culls):**
  - Megazyme K-TSTA kit
  - Use of thermostable α-amylase and amyloglucosidase[3]



MIP Assays



Total Starch Assay

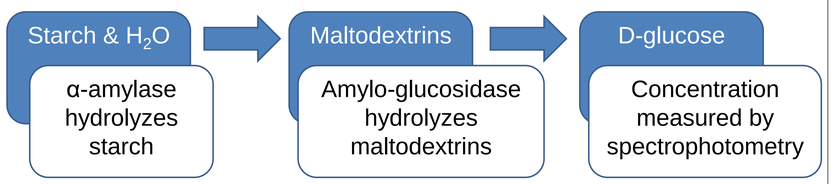


Figure 1. Procedure for Total Starch Measurement

Results

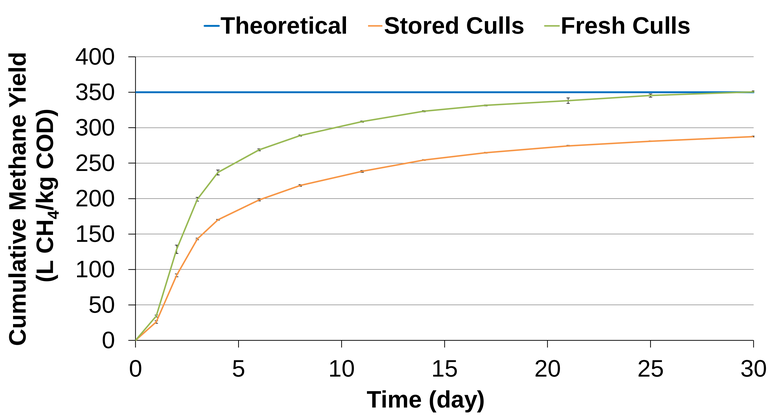


Figure 2. Cumulative Methane Yield for Fresh and Stored Culls

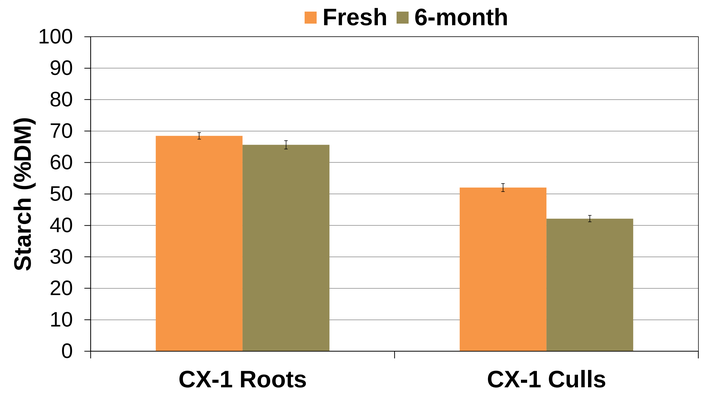


Figure 3. Starch Concentrations (Dry Matter Basis)

- Fresh culls yielded 350 L CH_4/kg COD (100% of the theoretical) while culls stored for 6 months yielded 288 L CH_4/kg COD (82% of their potential).
- The fresh roots had a starch content of 69% DM while the stored roots had a starch content of 66% DM. Thus, starch was conserved over the six month postharvest storage period.

Conclusions

- The fresh culls reached their theoretical methane potential, thus sweetpotato culls are an ideal co-product that can supply bioenergy through anaerobic digestion.
- The postharvest storability of the CX-1 roots promotes this crop as a year-round feedstock for ethanol production.
- The CX-1 industrial sweetpotato cultivar would provide a renewable and carbon-neutral bioenergy source that could be utilized in Florida.

Future Work

- Total starch content of CX-1 roots should be evaluated after one year of postharvest storage.
- Other cultivars of both industrial and table sweetpotatoes should be evaluated for starch conservation over time.

References

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Acknowledgements

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