Cost Effective Soy-Based Garden Pots

Progress of Work

PI(s): Nita Yodo and David Grewell, North Dakota State University

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1. Project Summary

This work will develop a novel bioplastic formulation that will incorporate soy-based fractions that will improve the performance of the pots while being cost-competitive. The new pots will not only be fully biobased, degradable, and provide inherent fertilizer for the plant growth, but they will also prevent root circling which will promote plant health and fruit yield, e.g., in tomatoes and peppers.

2. Objectives of the research

The measurable objectives that will be accomplished by this research are:

1. Test plant health and yield with containers produced from four formulations for 2 months in NDSU greenhouses
2. Determine decomposition rates for the containers produced from the various formulations.
3. Perform economic analysis with a targeted price increase of less than 25%
4. Identify product (container) performance in terms of consumer acceptance by distributing to various commercial growers

3. Completed work

Activity A (completed): Pellets of two new formulations were compounded at NDSU:

1) Control (Polyethylene) Will be purchased from commercial source
2) Existing formulation from SelfEco (PLA +DDGs)
3) New formulation 1 (70% PLA + 30% soy hulls and carbohydrate)
4) New formulation 2 (65% PLA + 30% soy hulls and carbohydrate + 5% SPI, soy protein isolate)

The team is currently characterizing the formulations detailed above for strength and toughness. PLA were obtained from NatureWorks and soy hulls from Carrington Research Extension Center. The PI(s) had SPI in-hand. Soy hulls were first ground to approximately 100 um prior to compounding.

(a) PLA (3001D) (b) Soy Hulls (before grinding) (c) SPI Powder

Figure 1. Materials for the new formulations

Status: New formulation 1 and 2 were compounded and awaiting final pelletizing. After pelletizing, the materials will be forwarded to SelfEco for molding into garden pots. Meanwhile, the PIs will plan for growth studies. Horticultural crops will be grown in NDSU greenhouses as soon as the pots are received from SelfEco (expected to start in February 2021).

4. Preliminary results

N/A

5. Work to be completed

As seen below, to date, a portion of task as has been completed.

Table 1. Gantt chart for proposed project

Tasks	Year 1				Year 2				KPIs*	Measurable Milestones/ Outcomes
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
A) Develop and characterize four pellets formulations at NDSU	X	X							PS, TC	- 4 pellets formulations - Pots are molded by SelfEco and Ainong
B) Test performances of fruit-bearing plants and flower crops grown in pots from Part A									PS, TC, KG	- Plants are grown in 2 months in NDSU greenhouse - Posts decomposed after 4 months
C) Conduct techno-economic and sensitivity analysis to ensure cost competitiveness									KG, TC	- 25% increase in short-term cost savings - 65% increase in the long-run
D) Perform customer acceptance study as a part of technology transfer to industry partners									PS, KG	- Pots sent to various commercial growers for evaluation - Products' strengths and weaknesses are identified
E) Finalize specifications and market placement of the proposed products									PS, KG	- Final formulations for commercial-scale are determined - Pots are distributed to local garden vendors

* Notes: X = completed, Product specification (PS)- in terms of pellets formulations, targeted thermomechanical properties, degradation rate, etc., knowledge generated (KG) – in terms of plant health, fruit yield, etc., and targeted costs (TC).