# Evaluation of various bio-plastic one- gallon containers for impact of the nursery environment on the pot durability, appearance and for the pot's influence on plant growth

Principle investigators: Dr. Hannah Mathers, Dr. Gerardo Ramirez, Luke Case

## Background

Over 4 billion plastic containers are used each year in the container-crop horticultural industries. Ninety eight percent of these 4 Bn will end up in US landfills representing > 1.6 Bn pounds of discarded petroleum-based plastics. This tremendous waste is the most substantial sustainability issue facing these industries.

## Materials and Methods

Two species were evaluated in the bio-plastic study at OSU, *Sedum pachyclados Forsythia ovata 'Northern Gold.'* The sedum from obtained from Millcreek Gardens LLC**,** Ostrander, OH as one 80 cell seedling plug tray where each cell plug volume was 16cc, on April 24, 2013. The forsythia was obtained as bareroot liners from North Branch Nursery Inc., Pemberville, OH, on April 23, 2013. The sedum and forsythia were potted into one gallon pots May 13, 2013. Eight one gallon containers of each of eight types of pots were shipped from Iowa State University (ISU), Ames, IA on June 10, 2013 and were received at Ohio State University (OSU), Columbus, OH, June 14, 2013. The Bio-plastic trial was initiated on June 30, 2013 with 8 pot types at OSU in a retractable roof greenhouse (Cravo). The pots were placed on black ground fabric, laid on top of a gravel bed, to prevent rooting into the gravel (Fig. 1).

**Fig. 1.** Bio-plastic container study at Ohio State University, Columbus, Ohio (October 2013).

Each pot type was replicated 4 times in a completely randomized design. The pot types consisted of two Mirel composites, Mirel & lignin (80/ 20) (#11) and, Mirel P1008 (10% Starch) (#13-G); one polyamide composite and blend, PolyAmide + PLA (70/30) (#17); one Aspen Research Corporation, Maple Grove, MN pots, Recycled PLA

# 2 (#24); one control, high density polyethylene pot (HDPE) (#26-G); and, three coated fiber containers, Paper-fiber (Polyurethane - one coat) (#27-G), Paper-fiber (Polyurethane - two coats) (#28-G) and Paper-fiber (Polyurethane – no coat) (29-G).

Mirel™ was obtained from Metabolix ® it is a bio-based Polyhydroxyalkanoaste (PHA). The Mirel prodcuts used in this study are PHA/ lignin – cellulose fiber composites. The cellulose and fibers are supplied from corn stover and Dried Distillers Grains with Solubles (DDGS). DDGS is a co-product of the ethanol production process, is a high nutrient feed valued by the livestock industry. When ethanol plants make ethanol, they use only starch from corn and grain sorghum. The remaining nutrients - protein, fiber and oil - are the by-products used to create livestock feed called dried distillers grains with solubles. A third of the grain that goes into ethanol production comes out as DDGS. Each bushel of grain used in the ethanol-making process produces 2.7 gallons of ethanol; 18 pounds of DDGS and 18 pounds of carbon dioxide.

The Poly(lactic acid) or polylactide (PLA) is used in this study is a thermoplastic aliphatic polyester produced from renewable resources, such as corn starch through fermentation process. PLA is the most widely used bio-based and biodegradable polyesters. Polyamides are biodegradable poly(ester amide) (PEA) biomaterials derived from α-amino acids, diols, and diacids. PEAs are promising materials for biomedical applications such as tissue engineering and drug delivery because of their optimized properties and susceptibility for either hydrolytic or enzymatic degradation.

The paper fiber pots used consist of no, one or two coatings of polyurethane (Fig. 2). Three evaluations were conducted at one month after potting (1 MAP), 2 MAP and 3 MAP. Evaluations consisted of rating the quality of the pots and the quality of the plants, on a scale of 0 to 10, where 10 is perfect and $\geq$7 is commercially acceptable. Dry weights of plant roots and shoots were not taken at 3 MAP as an evaluation of plant and pot will be conducted post-overwintering in May, 2013.

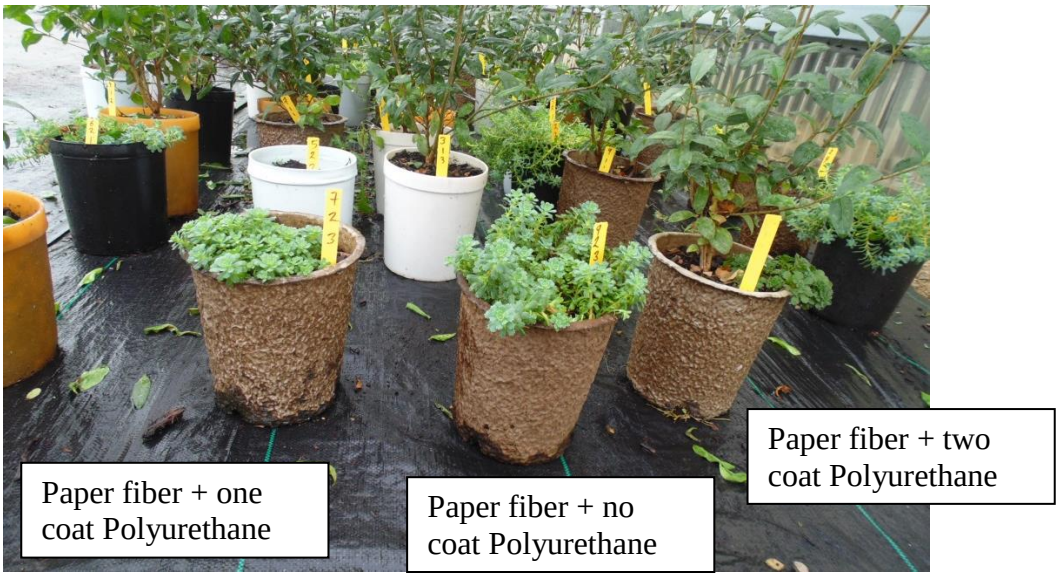

**Fig. 2.** There is little difference between no- and one- polyurethane coating; however, the two coating pot has a higher pot quality rating.