Sprayable Biopolymers for Improving Soil Health and Crop Productivity

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Abstract

Non-degradable synthetic plastic mulches such as polyethylene-based plastics persist in the environment long after their intended use is completed. Biopolymers (bioplastics), made of renewable and natural sources, are potential and cost-effective alternatives to widely used polyethylene-based plastics in agriculture. The present research has been designed to develop sprayable biopolymers (SBPs) from completely renewable materials, mainly from poultry feathers, woody biomass and spent mushroom substrate with zero-waste valorization approach. SBPs can be used as multi-benefit mulch in agricultural cropping systems. SBPs were prepared in liquid form and used as sprayable formulations in agricultural fields that formed hard thin layer bioplastics on soil surface once they dried out. The hard polymeric layer suppressed weed growth in soybean and corn production fields and completely biodegraded safely within a practical timeframe in real field conditions. SBPs had significant positive impacts on the soil health by releasing organic matter and nitrogen into the soil. SBPs provided beneficial conditions for crop growth, conserved the soil moisture and moderated the soil temperature. Although SBPs were found to be very promising bioproduct for agriculture, low stability and quick decomposition of organic materials in SBPs can limit widespread adoption of SBPs on large-scale applications in agriculture. Alternative solutions to overcome this challenge will also be discussed in detail in the presentation.

Keywords

Sprayable biopolymer; renewables; sustainable agriculture; biodegradable mulch, soil health; crop productivity.