Cover Crop Biomass Production for Five Summer Cover Crop Treatments Grown before Fall Bell Pepper (*Capsicum annuum*) Production in Florida

Authors: John Allar, Gabriel Maltais-Landry

Summer cover crops in Florida agroecosystems can improve nutrient cycling and soil quality while positively impacting crop yield. Cover crop mixtures may provide multiple functions to growers that might not be achieved by cover crop monocultures. We established a two-year experiment that compares how five summer cover crop treatments and a weedy fallow affect pepper yields and soil fertility/quality in Gainesville, Florida. Cover crop treatments include sunn hemp (*Crotalaria juncea*) monoculture (SH), sorghum sudangrass (*Sorghum bicolor x S. bicolor var. Sudanese*) monoculture (SSG), SH – SSG biculture (2sp), SH – SSG – buckwheat (*Fagopyrum esculentum*) polyculture (3sp), and SH – SSG – buckwheat – cowpea (*Vigna unguiculata*) – sunflower (*Helianthus annuus*) polyculture (5sp). Cover crops were grown for eight weeks from June until termination in August, after which bell peppers (Capsicum annuum) were planted. Cover crop growth dynamics and nutrient concentration were measured at cover crop termination as well as two weeks prior to termination. Soil nitrogen and phosphorus will be quantified throughout the two-year study along with several soil health indicators. Preliminary data on cover crop growth dynamics suggest that SH, 2sp and 5sp treatments accumulated the greatest total biomass with over 7000 kg/ha, with high within-treatment variability in SH and 2sp. We measured the lowest biomass in SSG, with 4600 kg/ha. Total biomass accumulation in the 5sp treatment showed substantially less within-treatment variability than all other treatments, although the contribution of individual species varied among plots for this treatment. These differences in cover crop biomass production could influence soil fertility/quality in addition to pepper yields.

Title: Aquatic Weeds: One man’s trash is another man’s treasure.

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Abstract:

Aquatic plants such as water lettuce (*Pistia stratiotes L.*), water hyacinth (*Eichhornia crassipes*), filamentous algae (*Lyngbya*), duckweed (*Lemna minor L.*) and torpedo grass (*Panicum repens L.*) are commonly found in farm canals within the Everglades Agricultural Area of South Florida. Their presence, particularly during the summer months is an environmental concern with regards to water quality, in addition to being a nuisance because of their ability to multiply and spread rapidly in open waters causing restricted drainage/irrigation flow and low dissolved oxygen levels. Chemical control is effective, however expensive. Hence, need exists to discover ways in which these weeds can be best managed or utilized. Allelopathy refers to the beneficial or harmful effects of one plant on its surrounding plants, both crop and weed species, from the release of biochemicals, known as allelochemicals. These chemicals can be released from parts of the plants either by leaching, root exudation, volatilization, residue decomposition, and other processes. The objective of this research is to study the allelopathic potential of aquatic plants, and apply it in the aspects of determining its use (i) as bioherbicides on terrestrial weeds, to test the inhibitory activity towards the seed germination and root growth of amaranth and nutsedge; (ii) as insecticides in sweet corn production; (iii) and as fungicide for brown rust and orange rust disease on sugarcane.

Digging a Little Deeper: An analysis on Environmental Education in Soil and Water Science for Rice Production

Leandra Gonzalez and Jehangir H. Bhadha

With unprecedented population growth and subsequent intensification of agricultural practices, soils are becoming degraded as time passes. In order to slow this degradation, growers need to have access to information about their soils to ensure best management practices are being used in their operations. This is especially important when addressing soils used to produce rice, being one of the worlds' major food crops, covering approximately 11% of global farmland. To approach this issue, a thorough analysis was conducted to compare environmental education in the growing community. It began with comparing the trends of using environmental education in a general aspect versus when pertaining to soils. It then focused on comparing environmental education within general farming practices to global rice production. It was found that even though there are increasing trends in environmental education in general, there is a gap between scientific knowledge and community education within the field of rice production. In order to close this gap, scientists can use their knowledge base for practical applications within the field. To build on this, a field study will be conducted to compare rice yields to flood depths in South Florida, leading growers to implement more sustainable growing strategies in their farming programs. From this, a nutrient budget will be developed and outreach services and environmental education will be offered to local growers, community members and other researchers, to bring about the best management practices for rice production in Florida and contribute to closing the gap between scientific knowledge and environmental education.

Title: Comparison of Soil C, N and P Dynamics in Sod-Based versus Conventional Peanut-Cotton Rotations in the Southeastern US.

Authors: James, Michael F.; Maltais-Landry, Gabriel

Abstract

Row crop farming in the Southeastern US requires substantial external inputs of synthetic fertilizers and pesticides that are costly to farmers. Dovetailing with this, concerns about sustainability of agriculture and the desire to maintain soil fertility and soil health while minimizing negative downstream impacts are on the rise. Using more complex crop rotation and integrating animals can help maintain high yields while minimizing input costs and environmental impacts. Sod-based rotations (SBR) established in Northern Florida augment a conventional peanut-cotton rotation by adding two years of bahiagrass that may be grazed or harvested for hay. These systems have been reported to increase yields, profitability, and soil carbon. Here, I present preliminary results of the effects of a stockless SBR system established in Quincy (FL) in 2000 on permanganate-oxidizable carbon (POXC), nitrogen mineralization, and resin-extractable phosphorus. Results were inconclusive at the 0-30 cm depth, however, additional properties and depths may respond more strongly to SBR systems. In addition, SBR systems where bahiagrass is grazed onsite may show greater impacts on soil fertility and soil health, which would affect the resilience and sustainability of these systems. Diversifying rotations, including animals and replacing fallow periods with cover crops has the potential to internally recycle nutrients and energy more efficiently, which could benefit farms in the Southeastern US.

Abbreviations:

CR: conventional Rotation

SBR: sod based rotation

POXC: permanganate-oxidizable carbon

Investigating Biological Soil Crusts and Nutrient Availability in Citrus Agroecosystems

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Abstract

Biological soil crusts (biocrusts) were recently discovered in Florida citrus agroecosystems. The impact of the biocrusts on the agroecosystem is largely unknown, however, similar biocrusts identified in desert ecosystems are known to increase inorganic nitrogen (N) availability, enhance soil moisture, and build soil carbon (C) stocks. Therefore, this research seeks to develop a comprehensive understanding of how the biocrusts in citrus agroecosystems in Florida impact soil N, C, and moisture dynamics and subsequently, soil microbiome function, diversity, and composition, at citrus critical growth stages. Soil core samples have been collected from crusted and non-crusted sites in three citrus agroecosystems in Florida. Soil cores were taken at a 15 cm depth and partitioned into regions including 0-1 cm, 1-5 cm, and 5-15 cm. Future plans include determining N, C, and moisture contents of crusted and non-crusted soil, characterizing the soil microbiome of crusted and non-crusted soil using 16S rRNA gene sequencing, and determining relative contributions of inorganic N to the citrus crop from the biocrust using a stable isotope N tracer method. Understanding the impact of biocrusts on soil physical, chemical, and biological properties has the potential to help optimize citrus management to promote beneficial microorganisms (biocrusts) and increase citrus economic productivity by reducing synthetic fertilizer requirements.

Abbreviations: Biological soil crusts (Biocrusts), Carbon (C), Nitrogen (N)

Nitrogen Fixation Capabilities and Cyanobacterial Composition of Biocrusts in an Agricultural Ecosystem

Kira Sorochkina, Patrick Inglett, Sarah Strauss

Several Florida citrus growers have recently observed a widespread presence of biocrust, a microorganism community living in the top centimeter of soil. In the face of pest and disease challenges for citrus, it is vital to research how biocrusts influence the agroecosystem to inform grower decisions. Biocrust's potential to provide a natural source of fertilizer for the crops through nitrogen fixation could translate into savings by using less artificial fertilizer. While biocrusts have been extensively studied in natural arid ecosystems, they have never been studied in a mesic agroecosystem. We will survey biocrust's nitrogen fixation capability and characterize cyanobacterial composition on four different citrus groves. We hypothesize that the biocrusts in citrus groves will have cyanobacterial genera analogous to the Southwestern deserts, including nitrogen fixing cyanobacteria. We expect the cyanobacterial community composition to significantly vary between different groves. Lastly, we hypothesize that biocrusts will have a detectable low range of nitrogen fixation rates due to high available nitrogen in fertilizer form. Presumably, lower fertilizer input would yield higher available nitrogen contribution from biocrusts. Paired samples of bare soil and biocrust covered soil will be collected from four different Florida citrus groves this Fall. Cyanobacterial microscopy will inform if genera expected in a biocrust are also present in an agricultural setting, and whether these cyanobacteria fix nitrogen. 16s rRNA gene sequencing and qPCR will quantify the cyanobacterial community composition. Controlled incubations with acetylene and ^{15}N will quantify nitrogen fixation rates under light and dark conditions.