1 December 2025 SSM 104

MATERIALS AND BIOMATERIALS SCIENCE AND ENGINEERING

Natural Rubber: a Critical Agricultural Material and the Development of Domestic Alternatives

ABSTRACT: Drainage water is produced on the west side of the San Joaquin Valley when excess irrigation water percolates beyond the root zone of the saline soils carrying soluble salts into the drainage water. Disposal of this saline drainage water can be problematic for the growers due to the high levels of naturally occurring salts, including boron (B) and selenium (Se), which are potentially toxic to crop production and the biological ecosystem, respectively. If drainage water reuse is to be considered as on-farm site drainage water management strategy, especially under drought conditions, alternative drought and specifically salt and tolerant crops must be identified if such sources of water, i.e., drainage water, are used. One such candidate is the drought tolerant plant called 'guayule', an arid-adapted, low-input perennial plant native to Mexico and southern Texas. It can be grown on lands that are unsuitable for major crops, and it may be a plant to consider for waters of poor quality. Guayule can withstand a lack of water for periods of time, harsh temperatures, minimal nutrients, and shallow, stony and calcareous soils. These characteristics help make guayule an ideal crop to consider for use in marginal soil and/or with poor quality irrigation water, e.g., westside of the SJV, where water is scarce, expensive and may be of poor quality. Perhaps the single most valuable gift the desert-dwelling guayule plant offers is its production of a superb natural rubber. This presentation will discuss the evaluation of guayule to saline irrigation. The risks and opportunities of developing a domestic supply of natural rubber will be outlined. The roles of several ARS locations will be reviewed. Finally, the Western Regional Research Service (Albany, CA) efforts under USDA-ARS National Program 306: Product Quality and New Uses Project, 'Synthesis and Production of Natural Rubber and Biobased Products', will be described.

Gary Bañuelos

Colleen McMahan

Grisel Ponciano

Refreshments: 1:45pm, **Seminar**: 2-3pm

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SPEAKER BIOGRAPHIES

Dr. Gary Bañuelos is a Plant and Soil Scientist at the USDA-ARS-Water Management Research Laboratory in Parlier, CA and an adjunct professor at California State University Fresno. Dr. Bañuelos obtained his Ph.D. in Plant Nutrition and Agriculture at the Hohenheim University in Germany. He has studied in the area of Plant Nutrition/Agriculture in both the United States and Germany and has conducted field research for over 28 years on the use of poor-quality water on alternative crops and has extensively researched and studied phytoremediation, an innovative, environmentally friendly green technology to clean up contaminated environments using plants and microbes. His integrated approach to field phytoremediation involves more than just the selection of alternative crops, but also considers crop rotation, irrigation and drainage management, product utilization (e.g., biofuel, animal feed, and biofortification), economic feasibility, and grower and public acceptance. Dr. Bañuelos has written over 260 peer-reviewed publications, has senior-edited six books, and has six patents on developing alternative crops for saline irrigation in Central California. He is nationally and internationally recognized for identifying and developing cropping systems for poor quality soils and with poor quality waters.

Dr. Colleen McMahan is a Research Chemist and Lead Scientist at the USDA Agricultural Research Service in Albany, California. She completed Chemistry and Polymer Science degrees at The University of Akron, Ohio, and her *Doctorat* in Physical Chemistry at *l'Université de Haute-Alsace* in Mulhouse, France, under Prof. Jean-Baptiste Donnet. At the Goodyear Tire & Rubber Company, she worked in rubber science and management of Physical Test Laboratories in support of tire compound development. At Advanced Elastomer Systems, L.P., an ExxonMobil company, Colleen led product development of thermoplastic elastomers. Since joining ARS her research interests include crop plants that produce natural rubber, with emphasis on the biochemistry and molecular biology of rubber biosynthesis. More recent research is addressing the challenge of 100% biobased rubber compound formulations.

Dr. Grisel Ponciano is a plant molecular biologist working with rubber producing plants. A native of Guatemala, she earned a B.S in Biochemistry from Universidad del Valle de Guatemala and a PhD in Plant Pathology from Kansas State University. After graduate school, she did postdoctoral work with bacterial blight disease of rice at San Francisco State University in San Francisco, CA. Dr. Ponciano joined USDA-ARS at the Western Research Regional Center in Albany, CA in 2008 working with potato leaf blight as a postdoctoral researcher. In 2010 she joined the natural rubber lab where, under various appointments, she has since focused on metabolic engineering of plants to improve rubber production. Her molecular biology, plant physiology, plant biotechnology and biochemistry knowledge have been instrumental in guiding research to dissect the molecular mechanisms of rubber biosynthesis necessary to inform stakeholders to improve guayule (*Parthenium argentatum*), a rubber crop currently in development in the US and other countries. Under her guidance, the first genome editing project of guayule is underway. Dr. Ponciano serves as the current President of the Association for the Advancement of Industrial Crops.

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