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Engineering & Food Production



**Yuan Liu** - Identification and reproductive manipulation of Wolbachia in the fall armyworm, *Spodoptera frugiperda*.

Wolbachia is the most abundant bacterial endosymbionts. It can play an essential role in the development, reproduction, nutrition metabolism, and immune responses of insects. To date, Wolbachia is well studied within whiteflies, aphids, psyllids and mealybugs, but many important aspects of the interaction between Wolbachia and the fall armyworm, *Spodoptera frugiperda* host remain unclear. Here, the infection status of Wolbachia in different tissues and provinces of *S. frugiperda*, including Yunnan, Guangxi, Hainan, Guangdong and Fujian were assessed. The phylogenetic relationships of Wolbachia from different *S. frugiperda* populations and their biology were also examined. Results revealed that for the first time, Wolbachia was found in ovary and salivary gland of *S. frugiperda* adults. And Wolbachia infection rates were 33.33% in Yunnan, 23.33% in Guangxi, and 12.97% in Hainan respectively. Phylogenetic analyses revealed that all the Wolbachia from different *S. frugiperda* populations belonged to the wPip strain within supergroup B. Moreover, it can decrease the insulin titers and result in reduced fecundity of *S. frugiperda*. This study will provide a foundation for to develop potential biocontrol techniques of Wolbachia against *S. frugiperda*.

**Stephen Oselu** - Production and characterization of camel milk yoghurt containing different types of stabilizing agents.

As of 2020, Kenya was ranked as the best camel milk producer in the world with an annual production of 1.125 million tonnes. Somalia and Mali are the second and third best camel milk producing countries with an annual production capacity of 0.969 and 0.271 million tonnes, respectively. Camels thrive and produce significant amount of milk when the other species living in harsh climatic conditions succumb. Despite the high camel milk production volumes, about half (50%) of the camel milk produced goes to waste. This is due to poor hygienic handling and minimal or no value addition and processing of camel milk into products such as yoghurt. In Kenya, there is a limited number of camel milk yoghurt products that are only available through the cottage industry. The main problem hindering the production and penetration of camel milk yoghurt into the market is its unacceptable texture, mouthfeel and viscosity that do not conform to what consumers are familiar with in bovine milk yoghurt. Camel milk yoghurt produced under similar conditions to bovine milk yoghurt is known to have weak structure and thin consistency. This thesis aimed at improving the physicochemical properties of camel milk yoghurt through incorporation of various stabilizing agents. Camel milk yoghurt formulations were produced using varying concentrations of starches (corn starch or modified starch) from 2, 2.5 or 3% and use of 0.075% calcium chloride. The physicochemical properties (TTA, pH and viscosity) of camel milk yoghurt were monitored during fermentation from 0-6 hrs. The syneresis and water holding capacity in addition to TTA, viscosity and pH were monitored during storage after 1, 7, 14 and 21 days. Camel milk yoghurt with 3% corn starch recorded the highest viscosity of 0.82 Pa.s which is twice as that of bovine milk yoghurt which recorded a viscosity of 0.35 Pa.s. Addition of calcium chloride led to a further increase in viscosity of camel milk yoghurt to 0.96 Pa.s (three times bovine milk yoghurt) but also increased the syneresis of camel milk yoghurt. Camel milk yoghurt containing 2.5 % modified starch and 0.075% calcium chloride showed best viscosity results on storage and on sensory evaluation.

**Alejandro Quezada** - Nondispersive infrared (NDIR) sensors application to track carbon footprint impact of municipal organic waste management strategies.

Differences in waste collection systems, waste treatment methods, and energy sources in cities mean that organic waste can undergo markedly different treatment pathways. Depending on the city, organic waste can be collected by a zero-emissions electric waste collection vehicle or a diesel truck; can be transferred through a facility where electricity comes from hydropower or natural gas; and it can end up in the landfill or be processed in a biodigester or compost windrow and be beneficially reincorporated into the soil. These combinations of different technologies will impact differently the GHG emissions per kilogram of treated organic waste and the total GHG emissions from the entire system, the potential to sequester carbon, and other environmental impacts. Information regarding the emissions and sequestration potential of receiving locations where organic waste products are either disposed of or put to beneficial use would benefit researchers and policymakers. This research will provide new and vital information about the amounts, quality, distribution, and variability of organic waste within Nova Scotia. Further work will be needed to assess how different policy environments may lead to changes in GHGs related to waste management.

**Jikky Jayakumar** - Extraction of natural pigment - bixin using improved extraction methods.

Bixin, a natural pigment, is obtained from the pericarp of the annatto seeds. It has a broad scope in food industries due to its extensive color range of red, orange, and yellow tint and its antioxidant properties. Bixin is a fat-soluble compound, on the extraction of annatto seeds with solvents it imparts red-orange color. Bixin extraction is a crucial process because of its sensitivity to light, temperature, and pH. To yield maximum and good quality bixin with antioxidant properties an improved method of extraction is required. In this study the bixin was extracted using an improved namely microwave-assisted extraction method and ultrasound-assisted method by varying the independent variables like solvent (ethanol and methanol) temperature (50, 60, and 70OC) seed: solvent ratio (1:5, 1:10, and 1:15), and extraction time (10, 20, and 30 min). The ultrasound-assisted method was found to be the best method to extract bixin using ethanol as a solvent.

**Amwoma Lorraine Moindi** - The impact of pulse electric field treatment on oxidation, color, & sensory attributes of turkey breast meat.

PEF is a novel non-thermal processing technology with potential to cause physical changes to muscle tissue. This in turn alters the sensorial aspects of meat positively (Tenderization) or negatively off-flavour (off-flavor development). Off flavor development should be identified prior to investigating PEF in meat tenderization. Turkey meat is particularly prone to oxidation therefore this study sought to investigate the effect of PEF treatments on the quality attributes of turkey breast meat. PEF treatments did not induce adverse effects on the lipid oxidation of the turkey meat across the anaerobic storage conditions. The voltage, frequency and pulse number in PEF treatments did not induce instrumentally measured lipid oxidation, texture and color on either fresh or frozen turkey meat samples. PEF treated samples were different from controls in terms of sensorial assessed texture and odor.

**Patrick Hennessy** - Precision Agriculture Applications of Real-Time Machine Vision in North American Wild Blueberries (*Vaccinium angustifolium* Ait.)

Wild blueberries (*Vaccinium angustifolium* Ait.) are a perennial crop native to northeastern North America. Despite their perennial nature, commercial wild blueberry fields are managed on a bi-annual cycle. The fruit is harvested using mechanical pickers that require manual inputs from an operator to optimize berry recovery. The height of the picking head on tractor-mounted harvesters must continually be adjusted to maintain the picking teeth in an optimal position and to avoid foreign objects. Uniform applications of agrochemicals are used for weed and insect control, and disease prevention. More efficient use of agrochemicals could be achieved through spot-targeting areas of fields requiring treatment. Deep learning, a form of artificial intelligence, can be used to automatically make decisions. Specifically, convolutional neural networks (CNNs) can classify images, or objects within images, in real-time. Machine vision systems using CNNs have been successfully used to identify weeds and ripe fruit in wild blueberry fields. A harvester was outfitted with a 3D camera and a CNN which could detect the location of ripe berries and automatically adjust the height of the picking head, which reduced operator stress. A sprayer that relies on machine vision to target areas of fields needing treatment will reduce the volume of agrochemicals needed.