

Abstracts of Some Papers Presented at the 2010 Annual Meeting of the Kentucky Academy of Science

Edited by Robert J. Barney

AGRICULTURE

Evaluation of Sunflower (*Helianthus annuus* L.) Cultivars for Cut Flowers. CHRISTOPHER G. FERGUSON, MARTIN J. STONE, and ELMER GRAY*, Department of Agriculture, Western Kentucky University, Bowling Green, KY 42101.

The sunflower (*Helianthus annuus* L.), an ancient cultivated crop for oilseed production, more recently has gained acceptance as a cut flower in the florist industry. Objectives of the present study were to survey available sunflower cultivars for adaptability to Kentucky growing conditions and for suitability to local florist markets. In 2011, sunflower cultivar trials were conducted at Bowling Green (36.93 N, 86.47 W) and Owensboro (37.78 N, 87.14 W) Kentucky. The randomized complete block design included 18 diverse cultivars and three replications. An experimental unit consisted of 10 plants of each cultivar spaced 30 × 60 cm. apart. Data were collected on seedling emergence, days to flowering, plant height, head diameter, stem diameter, branching, petal color, pollen production, and vase life. Twice weekly harvests of flowering heads began 29 July and continued through mid-September resulting in 9 and 10 harvests in Bowling Green and Owensboro; respectively. Flowering heads were evaluated by both lay and professional groups. The data on plant and head characteristics are being stratified to determine the most adapted cultivars for growing in Kentucky and the ones most acceptable by the florist industry.

Effect of Tassel Removal for Baby Corn Production in Kentucky. CHRISTOPHER G. FERGUSON*, ZHENG WANG, MARTIN STONE, and ELMER GRAY, Department of Agriculture, Western Kentucky University, Bowling Green, KY 42101-3576.

Baby corn (*Zea mays* L.) consists of unfertilized young ears harvested at silk emergence. The 2011 study was a culmination of four successive years of production and evaluation of baby corn at Western Kentucky University (36.93 N, 86.47 W). The objective was to compare the effect of tassel removal on baby corn (BC) production on four cultivars, two field ('N77P-3000GT', 'N68B-3000GT') and two sweet ('Silver Queen', 'Peaches N Cream') corns. Results indicated that tassel removal gave significant increases ($P < 0.01$) of BC ears across harvests (H) and cultivars; however, the effect was not consistent over treatments. For harvests, the difference due to detasseling was highly significant ($P < 0.01$) for H1, significant ($P < 0.05$) for H2 and H3, but not significant ($P > 0.05$) for H4. For cultivars, numerical values were higher for detasseled than non-detasseled treatments in the first three harvests

for each cultivar, but significant ($P < 0.05$) only for Peaches N Cream. Quality of BC from both tassel treatments decreased in H3 and H4. Further study is needed to determine economic returns of detasseling BC.

Developing a Biofilter for Remediation of Pesticide Residues in Runoff Water. GEORGE ANTONIOUS, College of Agriculture, Food Science, and Sustainable Systems, Department of Plant and Soil Sciences, Kentucky State University, Frankfort, KY 40601.

Bioremediation is the use of living organisms, primarily microorganisms, to degrade environmental contaminants into less toxic forms. Nine biobeds (ground cavity filled with a mixture of composted organic matter, topsoil, and a surface grass) were established at Kentucky State University research farm (Franklin County, KY) to study the impact of this practice on reducing surface runoff water contamination by residues of dimethazone and trifluralin herbicides arising from an agricultural field. Biofilter systems were installed at the bottom of the slope of specially designed runoff plots to examine herbicides retention and degradation before entering streams and rivers. In addition to biofilter systems, three soil management practices: i) municipal sewage sludge (SS), ii) SS mixed with yard waste compost (SS + YW), and iii) no-mulch rototilled bare soil (NM used for comparison purposes) were used to monitor the impact of soil amendments on herbicide residues in soil following natural rainfall events. Organic amendments increased soil organic matter content and herbicide residues retained in soil following rainfall events. Biofilters installed in NM soil reduced dimethazone and trifluralin by 84 and 82%, respectively, in runoff water that would have been transported down the land slope of agricultural fields and contaminate natural water resources. Biobeds installed in SS and SS + YW treatments reduced dimethazone by 65 and 46% and trifluralin by 52 and 79%, respectively. The use of biofilters in on-farm bioremediation of pesticide residues in surface runoff water might provide a potential solution to contaminated runoff and seepage water arising from agricultural production operations.

Evaluation of Constructed Wetlands for Nitrate and Phosphorus Removal. ERIC T. TURLEY*, and GEORGE F. ANTONIOUS, College of Agriculture, Food Science, and Sustainable Systems, Department of Plant and Soil Sciences, Kentucky State University, Frankfort, KY 40601.

Constructed wetlands are designed and utilized to reduce or eliminate the effect of agrochemicals on water

quality. The use of agrochemicals, such as fertilizers, requires practices for remediation of these environmental contaminants. At Kentucky State University Research Farm, twelve constructed wetland microcosms were established. Six microcosms were filled with river gravel and six with grade #2 limestone. Sweet flag plants, *Acorus calamus*, were planted in six microcosms (nine plants in three river gravel microcosms and nine plants in three limestone microcosms). The plants were observed for growth and performance in the two types of rocks. Water samples were collected at regular time intervals to monitor the performance of the microcosms. Improvement was noted in orthophosphate, nitrate, ammonia, and dissolved oxygen concentrations. The results revealed that microcosms containing limestone, with and without sweet flag, had a 23% reduction of orthophosphate ions compared to microcosms with river gravel with and without sweet flag. The $\text{NO}_3\text{-N}$ content in microcosms containing limestone and planted with sweet flag was reduced by 42% compared to microcosms containing river gravel and planted with sweet flag. Microcosms containing either limestone or river gravel and sweet flag had increased dissolved oxygen content over microcosms containing either limestone or river gravel and no plants. The $\text{NH}_3\text{-N}$ content in all microcosms was reduced to near immeasurable amounts.

Half-lives of Endosulfan Isomers on Field Treated Vegetables. KYLA ROSS^{*1}, GEORGE ANTONIOUS¹, and TEJINDER KOCHHAR², ¹College of Agriculture, Food Science, and Sustainable Systems, ²Department of Biology, Carver Hall, Kentucky State University, Frankfort, KY 40601.

Endosulfan 3 EC, a mixture of α - and β -stereo isomers, was sprayed on field-grown pepper and melon plants at the recommended rate of 0.44 kg A.I. acre⁻¹. Plant tissue samples (leaves and fruits) were collected 1 h to 30 days following spraying and analyzed for endosulfan isomers. Analysis of samples was accomplished using a gas chromatograph (GC) equipped with a mass detector in total ion mode. The results indicated the formation of endosulfan sulfate as the major metabolite of endosulfan sulfite and the relatively higher persistence of the β -isomer as compared to the α -isomer. The initial total residues (α - and β -isomers plus endosulfan sulfate) were higher on leaves than on fruits. On pepper and melon fruits, the α -isomer, which is the more toxic to mammals, dissipated faster ($T_{1/2}$ = 1.22 and 0.95 d, respectively) than the less toxic β -isomer ($T_{1/2}$ = 3.0 and 2.5 d, respectively). These results confirm the greater loss of the α -isomer compared to the β -isomer, which can ultimately impact endosulfan dissipation in the environment. The higher initial residues of endosulfan on pepper leaves should be considered of great importance for timing field operations and the safe entry of harvesters due to the high mammalian toxicity of endosulfan.

Antioxidants and Heavy Metals Content of Hot Pepper. McKENZIE JOHNSON^{*1}, GEORGE ANTONIOUS¹, and TEJINDER KOCHHAR², ¹College of Agriculture, Food Science, and Sustainable Systems, ²Department of Biology, Carver Hall, Kentucky State University, Frankfort, KY 40601.

Hot pepper accessions that strongly accumulate heavy metals in their edible portions should be regarded as potential source of heavy metal contamination in the food supply. Phenols, ascorbic acid, capsaicin, and β -carotene are some of the classes of naturally occurring compounds having antioxidants activity in hot pepper. However, elevated concentration of heavy metals in hot pepper fruits could expose consumers to potentially hazardous chemicals. The main objectives of this investigation were to: i) to select candidate accessions of hot pepper having high concentrations of phytochemicals for use as parents in breeding for these antioxidant compounds, and ii) assess if hot pepper genotypes that contain great concentrations of capsaicin are also heavy metals (Cd, Cr, Ni, Pb, Zn, Cu, Mo) accumulators. Seeds of hot pepper (*Capsicum chinense*) were collected from Belize, Brazil, Colombia, Ecuador, Mexico, Peru, Puerto Rico, and U.S. and planted in a silty-loam soil. Fruits of PI-640900 (U.S.A.) contained the greatest concentration of capsaicin (1.52 mg g⁻¹ fruit) and dihydrocapsaicin (1.16 mg g⁻¹ fresh fruit), while total major capsaicinoids (capsaicin and dihydrocapsaicin) in the fruits of PI-438648 (Mexico) averaged 2 mg g⁻¹ fruit. PI-152452 (Brazil) and PI-360726 (Ecuador) contained the greatest concentrations of ascorbic acid (1.2 and 1.1 mg g⁻¹ fruit, respectively). While PI-438648 (Mexico) contained the greatest concentration of total phenols contents (349 $\mu\text{g g}^{-1}$ fruit), PI-355817 (Ecuador) contained the greatest concentration of β -carotene among the other 63 accessions tested. Variability of these traits might be utilized via plant breeding approaches for their value-added health-promoting characteristics.

An Update on the KSU Pawpaw Breeding Program. KIRK W. POMPER^{*}, SHERI B. CRABTREE, and JEREMIAH D. LOWE, College of Agriculture, Food Science, and Sustainable Systems, Kentucky State University, Frankfort, KY 40601-2355.

The North American pawpaw [*Asimina triloba* (L.) Dunal] is a tree fruit native to the eastern United States, which is in the early stages of domestication. Pawpaw fruit have fresh market appeal for farmers' markets, community supported agriculture, and organic markets, as well as processing potential for frozen pulp production. New high yielding cultivars with excellent fruit quality would assist in the development of a pawpaw industry. Kentucky State University (KSU) serves as the National Clonal Germplasm Repository for pawpaw, and germplasm evaluation is an important research priority. Pawpaw germplasm has been screened for superior fruiting characteristics and trial as new pawpaw varieties.

Pawpaw genotypes in the KSU repository orchards under evaluation are from crosses of current pawpaw varieties or are open pollinated seedlings from a range of genetic sources. Some selections that produced high yields and excellent fruit quality have been selected for clonal propagation (budding onto rootstock) and field trials. Selections that have shown excellent fruit quality and yields include Hi4-1, Hi7-5, H3-120, G4-21, G4-25, G5-23, G6-120, G9-109, and G9-111. Most of the pawpaw advanced selections had similar budding success and vigor to controls and are in field trials. When the genetic diversity of KSU advanced selections were evaluated using Simple Sequence Repeat DNA markers, these selections displayed significant genetic diversity compared to pawpaw cultivars recently released by the PawPaw Foundation breeding effort. KSU advanced selections contain unique pawpaw germplasm that should enhance the genetic base of cultivars if these selections are released to the public.

Ethanol Production Potential from Pawpaw Fruit Agricultural Waste. BRANDON K. MAY*, MICHAEL BOMFORD, KIRK W. POMPER, JON CAMBRON, and TONY SILVERNAIL, College of Agriculture, Food Science, and Sustainable Systems, Kentucky State University, Frankfort, KY 40601-2355.

The finite nature and rate of depletion of fossil fuels has prompted discussion into the production of biofuels to supplement our national energy demands. Government mandates diverting corn or other grain products into cellulosic ethanol production has caused speculation into consequences of a reduced grain supply leading to increased food and livestock costs. Globally, studies are also being conducted to examine the potential useable sugars and starches derived from agricultural waste products ranging from olive mill waste, corn stover, peanut, and fruit waste. The pawpaw [*Asimina triloba* (L.) Dunal] is a native tree fruit and is a new high-value fruit crop in Kentucky. Pawpaw fruit have fresh market appeal for farmers' markets, community supported agriculture, and organic markets, as well as processing potential for frozen pulp production. After harvesting of the pawpaw fruit many poorer quality fruit remain unused in the orchard. Seed is a byproduct of pulp extraction of the poor quality fruit; the seed is valuable to nurseries, often selling for \$10 per pound. Pulp waste from seed extraction has potential for ethanol production. In initial experiments with pawpaw pulp waste from seed extraction, the extracted pulp sugar contents were found to be as high as 19 °Brix or 112.3 g/L and once processed would yield 10.3% alcohol by volume. Using methods devised by UC Davis for sugar to ethanol conversion, biofuel production potential of the pawpaw fruit appears promising from this agricultural waste. The potential for ethanol production and extraction methods for pawpaw pulp will be discussed.

Prime-Ark®45 and Prime-Jan® Primocane Fruiting Blackberry Production Grown Under Organic Culture in Kentucky. JEREMIAH D. LOWE*, KIRK W. POMPER¹, SHERI B. CRABTREE¹, JOHN R. CLARK², and JOHN G. STRANG³, ¹College of Agriculture, Food Science, and Sustainable Systems, Kentucky State University, Frankfort, KY 40601-2355, ²Fruit Culture & Breeding, 316 Plant Science Bldg. University of Arkansas, Fayetteville, AR 72701, ³Department of Horticulture, N-318 Agricultural Sciences North, University of Kentucky, Lexington, KY 40546.

Primocane-fruited blackberries are attractive to Kentucky growers because they can be grown organically and have the potential to produce a niche-market crop from late summer until frost. Therefore, locally produced fruit from primocane blackberry selections can be harvested from July until usually October, providing fruit for sale at farmers' markets, community supported agriculture, and organic markets. In June 2010, a blackberry trial was planted at the KSU Research and Demonstration Farm on the certified organic land. The planting contained four replicate blocks each of the selections of Prime-Jan®, a primocane-fruited selection from the University of Arkansas, and Prime-Ark®45, a newly released primocane-fruited blackberry. Plants were arranged in a completely randomized design, with four replicate plots each containing five plants of each selection or cultivar (total of 20 plants of each selection or cultivar) in 10-foot plots. This trial was managed with organic practices following the National Organic Program standards. A combination of cultivation, hand weeding, and straw mulch was used for weed control. Drip irrigation was used as needed. Ripe fruit were harvested from the plants twice weekly, Monday and Thursday, from July until October 2011. Harvest period, yield, and berry weight were recorded for all selections. Prime-Ark®45 had higher yield and greater berry size as compared to Prime-Jan®. Warm summer temperatures in 2011 appeared to reduced fruit set on Prime-Jan® as compared to Prime-Ark®45. Prime-Ark®45 appears to be a desirable cultivar well suited to Kentucky growing conditions.

Kentucky State University Pawpaw Processing: An Update. SHERI B. CRABTREE*, KIRK W. POMPER, and JEREMIAH D. LOWE, College of Agriculture, Food Science, and Sustainable Systems, Kentucky State University, Frankfort, KY 40601.

The pawpaw (*Asimina triloba*) is the largest tree fruit native to the United States and is being grown on a small scale commercially in Kentucky and surrounding states. Pawpaws produce unique fruit with creamy yellow-orange flesh and a flavor resembling a blend of mango, banana, and pineapple. The fruit's short shelf life and difficulty with postharvest handling and storage are impediments to commercial development. Marketing frozen fruit pulp as a value-added product could be one solution to this problem. However, pawpaw fruit pulp extraction is labor-intensive and made more difficult by the row of

large inedible seeds in the fruit, and valuable pulp may be lost through ineffective extraction methods. The objective of this study was to determine if processed pulp recovery rate differs by pawpaw cultivar. Three sets of five ripe fruit each of five pawpaw cultivars (KSU-Atwood, Mitchell, PA-Golden, Sunflower, and Susquehanna) were selected. Fruit were processed using a modified Roma Sauce Maker with a grape spiral and squash/pumpkin screen to separate seeds from pulp and macerate the pulp. Individual fruit and seed weights were measured to determine percent seed. Processed pulp recovery rate varied significantly among cultivars, with Susquehanna, KSU-Atwood, and Sunflower having a greater percentage of pulp recovered from fruit than Mitchell. Susquehanna, KSU-Atwood, and Sunflower had higher fruit weights than PA-Golden or Mitchell. With large fruit weights, a high rate of processed pulp recovery, and high fruit: seed ratio for more efficient processing, the cultivars KSU-Atwood, Susquehanna, and Sunflower are good choices for Kentucky pawpaw growers.

Beneficial Insects Associated with Fall Established Native Perennial Plant Borders. JERMAINE DUNIGAN*, JOHN D. SEDLACEK, and KAREN L. FRILEY, Kentucky State University, Frankfort, KY 40601.

Native perennial plants are ideal for use in sustainable landscapes and are beneficial to the environment because they create habitat for wildlife species including beneficial insects. Attracting beneficial insects using a farmscaping approach can be important in trying to establish sustainable methods of insect pest management in vegetable and fruit crops. Some researchers have suggested that non-crop vegetation such as grasses and floral strips planted in crop field margins can enhance predaceous arthropod and parasitoid populations. Therefore, the objective of this study was to compare several insect groups colonizing newly established perennial borders vs. non-mowed mixed grass/weedy pasture borders. This study was conducted at the Kentucky State University Research and Demonstration Farm in Franklin County, KY. Sixteen plant species, including big bluestem (*Andropogon gerardii*), thimbleweed (*Anemone virginiana*), New England aster (*Aster novae-anglica*), side-oats grama (*Bouteloua curtipendula*), purple coneflower (*Echinacea purpurea*), gray-headed coneflower (*Ratibida pinnata*), rattlesnake master (*Erygium yuccifolium*), common boneset (*Eupatorium perfoliatum*), blue lobelia (*Lobelia siphilitica*), bee balm (*Monarda fistulosa*), switchgrass (*Panicum virgatum*), foxglove beardtongue (*Penstemon digitalis*), hairy beardtongue (*Penstemon hirsutus*), slender mountain mint (*Pycnanthemum tenuifolium*), little bluestem (*Schizacharium scoparium*), and prairie dropseed (*Sporobolus heterolepis*), were established in 25 m × 2 m border rows replicated three times. Insects were sampled using four 15 cm × 15 cm sticky traps mounted to tobacco sticks in each border row. Lady beetles, solitary bees in the genus *Agapostemon*, soldier

beetles (*Chauliognathus pensylvanicus*), and green lacewings (*Chrysops* sp.) were caught in higher numbers in the native perennial border rows than the pasture borders.

Will Mowing of Primocane-fruiting Blackberries Affect Fruit Ripening? KAREN L. FRILEY*, JOHN D. SEDLACEK, KIRK W. POMPER, JEREMIAH D. LOWE, MICHAEL K. BOMFORD, SHERI B. CRABTREE, MARQUITA L. GRAYSON-HOLT, CHRISTOPHER M. WALES, and RACHEL S. HAYDEN, Atwood Research Facility, Kentucky State University, Frankfort, KY 40601.

Blackberry acreage has increased in Kentucky, while demand still often exceeds supply. The need for sustainable production practices is important for small and limited resource farmers as well as organic producers. Primocane-fruiting blackberries will set on both the overwintered canes as well as the current season primocanes. These varieties will produce two crops per year – the regular summer crop on the floricanes and then a later crop on the primocanes. ‘Prime Jim®’ and ‘Prime Jan®’, which are two commercially available primocane-fruiting varieties, were used in this study. Three replicates of each of the two varieties were initially mowed to ground level 6 April, while the second mowing occurred on 24 June. Fruit ripening in Prime Jim plots began to drop off in late August, while fruit ripening remained constant throughout the season in Prime Jan plots.

Stink Bug Species in Organic Blackberries. MARQUITA L. GRAYSON-HOLT*, JOHN D. SEDLACEK, KAREN L. FRILEY, KIRK W. POMPER, JEREMIAH D. LOWE, MICHAEL K. BOMFORD, SHERI B. CRABTREE, CHRISTOPHER M. WALES, and RACHEL S. HAYDEN, Atwood Research Facility, Kentucky State University, Frankfort, KY 40601.

Stink bugs (Hemiptera: Pentatomidae) are pests of blackberries in Kentucky. These insects insert their beak into drupelets to extract the juice and may also leave a foul odor and taste. Consumer demand for damage-free produce means that growers must use safe and effective management tactics for insect pests. Organic blackberry growers require sustainable and environmentally sound production methods to manage these insects. Spring-mowing of primocanes, on primocane fruiting blackberry varieties could avoid stink bug attack and delay fruit set. In 2011, three replicate plots of each of two varieties, ‘Prime-Jim®’ or ‘Prime Jan®’ were initially mowed to ground level on 6 April. Three replicate plots of each variety were then mowed a second time on 24 June. Stink bugs were sampled weekly using Florida Stink Bug Traps and hand collection methods. Stink bugs were found across treatments during the 2011 sampling period which extended from 11 July until September 29. Five stink bug species were identified during the period of fruit ripening in the planting. The green stink bug was the most abundant, followed by rice stink bug and then brown, twice stabbed and one-spotted stink bugs at 53%, 16%,

11%, 11% and 11%, respectively. Both hand collection of stink bugs and the use of the Florida Stink Bug Traps resulted in the capture of stink bugs. Although hand collecting required more time, more than twice as many stink bugs were captured compared to the stink bug trap, at 68% and 32%, respectively.

Does a Methyl Salicylate-based Lure Attract Lady Beetles to Blackberries? JUSTINA RIDDICK*, JOHN D. SEDLACEK, KAREN L. FRILEY, and JOY BIRIKE, Atwood Research Facility, Kentucky State University, Frankfort, KY 40601.

Kentucky produces approximately 45 ha of blackberries for a total value of \$1,000,000 annually. Demand for locally grown and damage-free blackberries usually exceeds the supply. Developing more sustainable production methods, including the use of beneficial insect attractants, such as a methyl salicylate-based lure, is important for the success of small and limited resource farmers. Eight blackberry plots, including six collaborators, were located in Franklin, Fayette, Scott and Shelby counties in Kentucky. Three plots were certified organic and the other five plots had no pesticides applied. Four sticky traps and posts were placed in all plots and two PredaLure® lures were placed in each of the PredaLure plots. Sticky traps were collected weekly for twelve weeks, placed in labeled ziplock bags and taken to the laboratory where lady beetles were identified using an illuminated magnifier. Total number per species and average number per trap were then calculated. Pink lady beetle, *Coleomegilla maculata*; seven-spotted lady beetle, *Coccinella septempunctata*; Asian lady beetle, *Harmonia axyridis*; parenthesis lady beetle, *Hippodamia parenthesis*; spotless lady beetle, *Cycloneda munda*; orange-spotted lady beetle, *Brachicantha ursina*; twice-stabbed lady beetle, *Chilocoris stigma*; and mildew eating lady beetle, *Psyllobora vigintimaculata* were caught in PredaLure baited sites. Parenthesis and seven-spotted lady beetles were not caught in non baited sites. PredaLure plots had more pink lady beetles, while non PredaLure plots had more Asian, spotless, and mildew-eating lady beetles.

Lady Beetles Associated with Sweet Corn Bordered by Pasture, Buckwheat or Sunflower Borders. JOHN D. SEDLACEK*, KAREN L. FRILEY, MARQUITA L. GRAYSON-HOLT, CHRISTOPHER M. WALES, and RACHEL S. HAYDEN, Atwood Research Facility, Kentucky State University, Frankfort, KY 40601.

Sweet corn, *Zea mays* 'Garrison®', was grown in replicated plots on Kentucky State University's Agricultural Research and Demonstration Farm in Franklin County, KY. Each 25 m × 12 m plot was bordered on each side of its length by a 2 m wide border of unmowed pasture, buckwheat (*Fagopyrum esculentum*), or dwarf sunflower (*Helianthus annuus* var. Big Smile). A randomized complete block design replicating each treatment five times was used and all plots were separated by 25 m. Yellow sticky traps (15 cm × 15 cm) were used to capture lady beetles. Two traps were deployed at canopy height between the edges and equidistant from the

ends of each border. Four traps were deployed in each sweet corn plot, one in the center of each plot quadrant. Traps were changed weekly through anthesis. Sticky traps were placed individually in ziplock plastic bags, labeled, and transported to the laboratory for insect identification and enumeration. Pink lady beetle, *Coleomegilla maculata*; Asian lady beetle, *Harmonia axyridis*; spotless lady beetle, *Cycloneda munda*; and seven spotted lady beetle, *Coccinella septempunctata* were caught in this study. The pink lady beetle was the most abundant species in all three border types and the sweet corn plots with 79% and 94% of the lady beetles caught in the borders and sweet corn, respectively. Pink lady beetle numbers decreased in buckwheat from 14 August through 27 August, but increased markedly in sweet corn from 14 August to 20 August, potentially indicating movement into the sweet corn.

Economics Systems, Role of Government, and Agriculture. STEPHEN A. KING, Department of Agriculture, Western Kentucky University, Bowling Green, KY 42101, Stephen.King2@wku.edu.

The role of government in U.S. agriculture is in great part defined by the Farm Bill. The current U.S. Farm Bill is referred to as the "Food, Conservation, and Energy Act of 2008" and its provisions have far reaching impacts over a broad range of constituents. It is set to expire in the year 2012, at which time a new Farm Bill is expected to be enacted. In addition to traditional commodity programs that directly impact the decisions of farmers, the legislation impacts the development of organic agriculture and biofuels markets, conservation of natural resources, nutrition and rural housing programs, agricultural research, among other areas. As a society, how do we decide what should and should not be included in the Farm Bill? Do we have any set of criteria for deciding the role of government in agriculture? How does current and past farm legislation influence the economic system of the U.S.? The work presented addressed these questions. It has been hypothesized that our socio-economic values influence the political process and thus the legislation that is developed and in turn the role of government in agriculture and therefore the economic system. In general the research suggests that current and past agricultural legislation moves our economic system toward the direction of centrally planned capitalism, that is agricultural resources are predominately owned by the private sector but their allocation is strongly influence by governmental policy. A set of criteria were proposed for guiding the role of government in agriculture.

Characteristics of and Reasons Why Farmers Choose Off-farm Work. CAITLIN N. CARTER, Department of Agriculture, Western Kentucky University, Bowling Green, KY 42101. caitlin.carter472@topper.wku.edu.

In recent years, farmers in the United States have been seeking off-farm work to supplement farm operations income. In many cases, income provided by off-farm work is the largest component of the farm household income. Previous research by the United States Department of

Agriculture – Economic Research Service suggests that the extent to which producers rely on off-farm income is dependent upon farm size and the type of enterprise. Results of this study reveal the most prominent characteristics of those farmers who choose off-farm work, the reasons why they choose off-farm work, and the extent of income that off-farm work provides to various categories of farm households.

ANTHROPOLOGY AND SOCIOLOGY

Acculturation and Body Weight Status of Chinese Immigrants in Kentucky. CECIL BUTLER*, LINGYU HUANG, and CHANGZHENG WANG, Human Nutrition Program, Kentucky State University, Frankfort, KY 40601.

Traditional Chinese diets are rich in vegetables and fruits and obesity is less prevalent among Chinese people. Immigrants adapt to American diets and behavior patterns. The objective of this study was to assess the acculturation and body weight status of Chinese immigrants in Kentucky. Thirty Chinese American immigrants were recruited to participate in the study at a large community event. The subjects were asked to fill out a questionnaire before they were given a free analysis of their body composition (body fat %) with a Tanita TBF-521 body composition analyzer. Body mass indexes were calculated from the body weight and height measured on-site. 84% of the participants were within normal body weight range with only 10.5% in the overweight and 5% in the obese category. Close to 50% of them speak Chinese and English about the same, but 28% speak mostly English. 46% of them read better in Chinese and speak mostly Chinese at home, but another 46% read better in English and speak mostly English at home. Only 38% speak Chinese only with friends, 53% speak only English or mostly English to friends. 30% think in mostly Chinese, 23% think in Chinese and English about the same, but 45% think in mostly English. 54% watch TV mostly in English with 30% do so mostly in Chinese. Over 73% listen to radio mostly in English with none listening to radio in Chinese. 54% identify themselves as Chinese American with 23% identifying with Chinese or American. 38% have mostly Chinese friends and 46% have some non-Chinese friends. 85% either agree or strongly agree with the statement that "I think of myself as being U.S. American." 69% are proud or very proud of their Chinese background. 69% eat mostly Chinese foods. 58% celebrate Chinese holidays most of the time. In conclusion, there are different degrees of acculturation among Chinese immigrants but the effect on their body weight status was not clear due to the limited number of subjects in this study.

Body Weight Perception and Willingness to Adopt Healthy Eating and Activity Behaviors among Kentucky Adults. ERICA COLEMAN*, LINGYU HUANG, CECIL BUTLER, and CHANGZHENG WANG, Human Nutrition Program, Kentucky State University, Frankfort, KY 40601.

Visitors to the 2011 Kentucky State Fair were recruited to fill out a questionnaire before they were given a free

analysis of their body composition (body fat %) with a Tanita TBF-521 body composition analyzer. 60% of overweight men considered themselves normal and 77% of obese men considered themselves only overweight. 15% of normal weight women considered themselves overweight, but only 21% of overweight women considered themselves normal and 51% of obese women put themselves in the overweight category. 80% of the participants would choose vegetables or fruits and nuts for snacks but 30% of the obese group would choose chips for a snack. 70% of the participants would learn to prepare vegetable dishes on their own but only 14% would do so by attending free workshops. 72% of participants were willing to add physical activities to their daily life such as walking but only 10% were willing to join a free club for exercise and 10% of the obese is willing to pay for an exercise program. 60% of the obese group was willing to cut soft drinks and 50% of the normal weight and overweight individuals were willing to drink water only. In conclusion, self-perception of body weight tended to lower the severity of weight problems in both men and women. Furthermore, self-perception of body weight status could affect the willingness to adopt healthy eating and activity behaviors.

BOTANY

Effect of Natural Plant (*Cocos nucifera*) Derived Oil on Ulcerative Colitis in a Murine Model. PRANAV CHANDRA*, and NILESH SHARMA, Ogden College of Science and Engineering, Department of Biology (TCNW), Western Kentucky University, Bowling Green, KY 42101.

Ulcerative colitis (UC) is a chronic disease of the colon or large intestine that causes inflammation and ulceration (tiny open sores) of the inner lining of the colon and rectum. Ulcerative colitis can occur in all areas of the colon. In patients with ulcerative colitis, the body's immune system over-reacts and body mistakes food, bacteria, or other internal materials in the colon for an invading substance and it signals the immune system to attack the material, thus irritating the colon. This irritation triggers a flare of ulcerative colitis symptoms likewise bloody, pus or mucus filled stools, diarrhea, cramping, abdominal pain and bloating. Highest incidences are seen in the United States, Canada, the United Kingdom and Scandinavia. Since the etiology of UC remains unclear, successful treatment strategies targeting large sections of affected population have not been found. UC is currently treated with medications that include a combination of anti-inflammatory, immunosuppressive and antibiotic drugs with limited remission and significant episodes of side effects; often patients become refractory and seek an alternative therapy. Lack of efficacious drugs to treat patients with different forms of inflammatory bowel disease underscores need for the development of a new and effective alternative therapy. Currently, the role of saturated fatty acids on human health is being revisited, and this issue is drawing significant attention specifically

in inflammatory and metabolic disorders. Effects of medium-chain saturated fatty acids (MCFAs) - like lauric and caprylic acid- have been little studied, and thus drawing much attention. Natural coconut (*Cocos nucifera*) oil is a rich source of MCFA, main constituent being lauric acid: a 12C-chain of fatty acids. Traditionally, coconut oil has been used as cooking oil in several parts of India and other Asian countries. Lauric acid converts to the fatty acid monolaurin in our body and has adverse effects on several microorganisms including bacteria, fungi, yeast and enveloped viruses. Lauric acid is one of the main components of human breast milk, and boosts immune system of children during infancy. Limited knowledge of inflammatory conditions coupled with a narrow range of therapeutic options necessitates investigating the role of natural products. Therefore, the present study focuses on the anti-inflammatory role of natural fatty acids derived from *Cocos nucifera* in the murine model of ulcerative colitis.

Genetic Diversity in Kentucky Spicebush Populations Using Simple Sequence Repeat Markers. RE'GIE SMITH*, KIRK W. POMPER, JEREMIAH D. LOWE, JACOB BOTKINS, and SHERI B. CRABTREE, College of Agriculture, Food Science, and Sustainable Systems, Kentucky State University, Frankfort, KY 40601-2355.

Spicebush (*Lindera benzoin* L.) is an aromatic small native shrub that grows in the moist, understory areas of Appalachia and has potential as a new niche crop for small farmers. Native Americans and early settlers used this plant traditionally as a tea. The berries can be used for jam and spicing of foods, and may have health benefits including antioxidant compounds. Native spicebush patches also can serve an important role in forest ecosystems in terms of fruit production for animals, soil erosion control, and enhancing insect biodiversity. Spicebush may serve to hold ecological niches by outcompeting invasive plants compared to those in unchallenged areas. Genetic diversity of native spicebush populations in Kentucky has not been examined. The objective of this study is to determine the genetic diversity in spicebush populations in Kentucky using simple sequence repeat (SSR) DNA marker systems. Leaf samples were collected from 20 spicebush plants in the forests at the Kentucky State University Environmental Education Center (EEC) and at a location near the Kentucky River. DNA was extracted using the DNAmite Plant Kit. Primers A7, A115, B105, and B122 were used to amplify SSR products that were separated with a 3130 Applied Biosystems capillary electrophoresis system. The software program Power Marker was used to examine genetic relationships among genotypes. The SSR markers generated showed genetic variation among the spicebush genotypes. A number of selections with unique genotypes will be sampled and propagated for study in the KSU germplasm collection for potential cultivar development.

Pawpaw Patch Genetic Diversity and Clonality and its Impact on the Establishment of Invasive Species in the Forest Understory. JACOB BOTKINS*, KIRK W. POMPER, JEREMIAH D. LOWE, and SHERI B. CRABTREE, College of Agriculture, Food Science, and Sustainable Systems, Kentucky State University, Frankfort, KY 40601-2355.

The pawpaw (*Asimina triloba*) is a native understory tree of 25 states of the east and midwest United States. Pawpaw's ability to compete with local invasive species in Kentucky has not been examined. The objectives of this study were two-fold: to determine the genetic diversity and clonality displayed in seven native pawpaw patches located at the Kentucky State University Environmental Education Center (KSU-EEC), the Kentucky River, Cove Spring Park, and the KSU Research and Demonstration Farm in Franklin County, using microsatellite markers; and to determine if patches reduced the incidence of invasive species. Twenty-five trees from seven patches in the four different locations were sampled for genetic analysis. Leaf samples were extracted using the DNAmite Plant Extraction Kit and products from four microsatellite loci were analyzed using a 3130 Applied Biosystems capillary electrophoresis system. String grids were created and invasive plants counted in three 10-meter squares in each of the patches and control plots outside of each patch. The number of plants for each invasive species within pawpaw patches was counted and compared to a control plots. Pawpaw patches displayed high genetic diversity among populations. Japanese honeysuckle (*Lonicera japonica*), garlic mustard (*Alliaria petiolata*), winter creeper (*Euonymus fortunei*), and colts foot (*Tussilago farfara*) were found in most locations; however, there was no significant difference in the incidence of invasive plants between the patches and the control plots. Pawpaw stem density may be important in the incidence of invasive plants within patches.

CHEMISTRY

Synthesis of Homoleptic Nickel (II) Complexes and Examination of their Coordination Dynamics in Solution. LAURA BISHOP*¹, DAVINDER KUMAR², CRAIG A. GRAPPERHAUS², and CHRISTOPHER S. MULLINS¹, ¹Division of Natural Science, Campbellsville University, Campbellsville, KY 42718, ²Department of Chemistry, University of Louisville, Louisville, KY 40292.

In this study, we have begun to examine the structural dynamics for a group of homoleptic nickel (II) complexes. All of the tridentate ligands have one fairly acidic proton attached to an oxygen or nitrogen donor atom that ligates the metal in the first coordination sphere. The ligand 2-(salicylideneamino)-1-hydroxyethane (H₂-SALAHE) has been studied extensively for a variety of applications, including the synthesis of single-molecule magnets derived from cluster compounds. A previous publication of the homoleptic Ni(II) complex of this ligand reported the single-crystal X-ray structure, wherein the nickel ion was found to be octahedrally coordinated by two of the ligand molecules. Our recent studies with this complex suggest

that the complex undergoes a coordination number change in solution to give a four-coordinate nickel complex. This complex has been found to give green crystals reminiscent of the octahedral structure upon recrystallization. Future work will utilize several spectroscopic techniques such as UV-Visible absorption, EPR, and NMR, etc. in order to study the fluxional nature of these complexes in solution.

COMPUTER AND INFORMATION SCIENCES

Statistical Analysis of Microarray Gene Expression Data from a Mouse Model of Toxoplasmosis. SHRIKANT PAWAR*, CHERYL D. DAVIS, and CLAIRE A. RINEHART, Department of Biology, Bioinformatics and Information Science Center, Western Kentucky University, Bowling Green, KY 42101.

Toxoplasmosis, caused by the protozoan parasite, *Toxoplasma gondii*, is a major cause of morbidity and mortality in patients with AIDS and an important cause of miscarriage, stillbirth and congenital disease in newborns. Previous studies have provided evidence that dietary supplementation with vitamin E and selenium is harmful during experimental toxoplasmosis in mice, whereas a diet deficient in vitamin E and selenium results in decreased numbers of tissue cysts in the brain and dramatically reduced brain pathology. The overall goal of the present study was to determine the impact of dietary supplementation with antioxidants on gene expression in the brains of non-infected mice and in mice infected with *T. gondii* using microarray analysis. RNA was isolated from the brains of C57BL/6 mice, and an Agilent Oligo Whole Mouse Genome Microarray (Agilent Technologies, Inc.) was performed. A total of 48 chips were normalized by Z ratios and the Data Driven Harr Fisch Normalization methods. Differentially expressed genes were identified by applying thresholds to identify significant values and the results were compared between the normalization methods. These differentially expressed genes and their respective fold change ratios were used in Ingenuity Pathway Analysis (IPA) software to analyze the pathways involved with these genes. The identified pathways associated with differentially expressed genes are very important in determining the impact of dietary supplementation with antioxidants on gene expression in the brains of mice infected with *T. gondii* and specific alterations of those pathways can help us in reducing the harmful effects of the same in future. Support from the National Center for Research Resources NIH Grant Number 2 P20 RR-16481 and from the WKU Bioinformatics and Information Science Center is gratefully acknowledged.

ECOLOGY AND ENVIRONMENTAL SCIENCE

Assessing Kentucky State University's Recycling Program. RE'GIE SMITH*, RODNEY RIPBERGER, BRANDAN BURFICT, DUSTIN HODGES, and JOHN D. SEDLACEK, Masters of Environmental Studies Program, Kentucky State University, Frankfort, KY 40601.

The purpose of this study was to conduct a recycling audit of six buildings on Kentucky State University's (KSU) campus and to conduct a survey of the attitudes,

perceptions and knowledge of faculty, staff and students about recycling on campus. A six-week audit was conducted of waste from two academic buildings, one administrative building, the student center, and one male and one female dormitory for a total of six campus buildings. Recycling bins were located in the six buildings and their locations were documented on maps. We collected a total of 815 lbs of waste; of the waste that was collected 361 lbs (44%) could have been recycled. Thirty six percent of the recyclables was plastic, 28% was paper and 24% was cardboard. The survey revealed that students recycle less compared to the faculty and the staff. The faculty use the recycling bins an average of 1.32 times per day, staff use the bins an average of 1.47 times per day, and the students use the bins an average of 0.66 times per day. The survey respondents' answers showed that they believe recycling is important and almost 97% are willing to help KSU recycle more. In fact, 81% of the respondents recycled prior to life at KSU, and only 3% consider themselves to not be "green," or to not take actions to promote a healthy environment. The census of students, faculty, and staff provided data that will help make recommendations for the KSU recycling program.

Winter Management of an Invasive Species, Garlic Mustard, *Alliaria petiolata*, in Wooded Habitat. JACOB BOTKINS*, RUSSELL WILLIAMS, ADAM GERUGHTY, and JOHN D. SEDLACEK, Masters of Environmental Studies Program, Kentucky State University, Frankfort, KY 40601.

Garlic mustard, *Alliaria petiolata*, is a biennial cool-season plant growing 0.5–1 m tall. It is an aggressive competitor for resources excluding native plants from their habitats. This plant is shade tolerant allowing it to invade mature woodlands, where it shades out native understory flora and produces allelopathic compounds inhibiting seed germination of other species. It is threatening the federally endangered Braun's rockcress (*Arabis perstellata*) known only from Franklin, Owen and Henry counties. The objective of this research was to quantify two methods of winter management of garlic mustard at the Julian Savanna State Nature Preserve in Franklin County, Kentucky. Hand removal, a 2% glyphosate solution and untreated control treatments were used. Plots were 1 m² in area. A thatching rake was used to hand weed while a hand held 0.5-liter sprayer was used to apply glyphosate to each plot. A digital camera was used to photograph each plot 1.5 m overhead before plot treatment on 16 February. Each plot was photographed nine weeks after treatment and weed control quantified using the NIH ImageJ program (U.S. National Institutes of Health). There was a 22% and 24% increase in garlic mustard and purple deadnettle foliage in glyphosate treated and hand weeded plots, respectively. There was >722% increase in garlic mustard and purple deadnettle coverage in untreated plots. Thus, a single application of glyphosate in mid-February or hand

weeding/surface tilling reduces, but does not eliminate, garlic mustard and purple deadnettle in wooded areas.

White Tailed Deer in Frankfort, Kentucky: Population Assessment and Implications for the Community. JON CAMBRON*, TERRELL HOLDER, MARK RASCHE, KIAH RODRIGUEZ, MIKE WARD, and JOHN D. SEDLACEK, Masters of Environmental Studies Program, Kentucky State University, Frankfort, KY 40601.

A spotlighting assessment of the population of white-tailed deer was conducted in five Frankfort city parks. Two to four replications were done on each park. Cove Spring Park's population was estimated at 24, Capitol View Park - 77, Fort Hill Park - 76, East Frankfort Park - 6, and Juniper Hills Park - 0. Based on a calculated estimate of deer/mi², Cove Springs and East Frankfort densities fell within the range of expected density based on mean densities of adjacent counties; Capitol View and Fort Hill did not. This could be because surveys of Capitol View and Fort Hill were not accurate or the densities are in fact much higher than expected in this region. To supplement the population survey, we did an informal assessment of the forest understory in three of the surveyed parks and looked at deer-vehicle collisions as a proxy for density. Understory vegetation was limited to a small number of species dominated by bush honeysuckle (*Lonicera* spp.) and very few tree saplings of any species were observed. In Fort Hill Park, the understory was essentially non-existent. There were 851 deer-vehicle collisions between 1 January 2001 and 31 December 2010, mostly occurring in October, November and December. The collision count over ten years, looking at only November, suggests a two or three year deer population cycle. The census combined with the informal vegetation assessment and incidence of deer-vehicle collisions in November suggests that deer in Frankfort may be approaching ecological carrying capacity.

Citizen Awareness of Invasive Plant Species in Kentucky. JOHN D. SEDLACEK*, ADAM GERUGHTY, JACOB BOTKINS, and RUSSELL WILLIAMS, Masters of Environmental Studies Program, and MARA MERLINO, and TIERRA FREEMAN, Psychology Department, Kentucky State University, Frankfort, KY 40601.

Non-native invasive species are one of the primary threats to biodiversity. Public support for invasive species management programs is critical to the success of such projects. Additionally, understanding the public's knowledge, attitudes and perceptions can assist with the development of outreach and educational activities. In order to assess the level of understanding of the invasive plant species threat, attitudes towards invasive species management and demographic factors influencing such attitudes, a questionnaire survey of 400 randomly selected members of the public in the greater Louisville, Lexington, Frankfort and Bowling Green metropolitan service areas was conducted. We developed a survey that determined an elementary level of awareness of invasive plants, people's understanding of

what is native vs. non-native, why these concepts matter, and if respondents are motivated to assist in invasive species removal. The survey was administered via Survey Monkey. Surprisingly, only 4.5% of the population invited to participate in the survey actually responded. Thus, drawing major conclusions from the data would not be advisable. However, the low response indicates that the vast majority of citizens are unaware of, or don't care about, the potential economic or ecological consequences of invasive species establishment. We provided all survey information to the Kentucky State Nature Preserves Commission who hopefully will be able to further address educational issues concerning invasive species and how to better market those messages in Kentucky.

GEOLOGY

Nutrient and Fecal Microbe Assessment of the Water Quality of Tates Creek, Madison County, Kentucky. KRISTOPHER H. CARROLL*, and WALTER S. BOROWSKI, Department of Geography and Geology, Eastern Kentucky University, Richmond, KY 40475.

Tates Creek is a significant tributary to the Kentucky River that has shown high levels of microbial and nutrient pollution. We sampled the waters of Tates Creek comprehensively by occupying 25 stations along its 13-mile length, collecting stream water at the confluence of major tributaries from its headwaters to the Kentucky River. Samples were collected four times between May and August 2011 during dry periods as well as immediately after rainfall events. We measured ammonium (NH₄⁺), nitrate (NO₃⁻) and phosphate (PO₄⁻) concentrations using colorimetry. Microbial samples were measured for total coliform and *Escherichia coli* using IDEXX Colilert-18 media. Background levels of NH₄⁺, NO₃⁻ and PO₄⁻ are typically ~0.2 ppm, 13 ppm, and 1.0 ppm, respectively. Nutrient concentrations generally increase during rainfall events, presumably because nutrients are flushed into the stream. Background counts of *E. coli* are typically ~100 cfu/mL but microbe counts reached 1,000–2,419 cfu/mL immediately following rain events. A sewage treatment plant exists approximately two miles from the headwaters and noticeably affects water quality. Nutrient concentration, especially NH₄⁺ and PO₄⁻, are markedly increased at the plant's outflow. These nutrients then decrease steadily in concentration downstream to background levels. In contrast, fecal microbe counts are high upstream from the plant, but fall to near-zero levels at its outflow, and then increase anew downstream. The treatment plant went offline on 19 July 2011, so we will be able to assess any changes in water quality and stream health in the future.

Suspended Sediment Concentration in the Brushy Creek Watershed, Kentucky. TYLER A. WADE*, and WALTER S. BOROWSKI, Department of Geography and Geology, Eastern Kentucky University, Richmond, KY 40475.

Suspended sediment concentration (SSC) can be used as a proxy for environmental health of stream water. For example, large sediment loads can cause harm to aquatic

life and are a mechanism for introducing and transporting fecal microbes. We measure SSC of the Brushy Creek watershed, located in Rockcastle, Pulaski, and Lincoln Counties, where the Eastern Kentucky Environmental Research Institute (EK-ERI) has been conducting an assessment of the watershed. Two auto-sampling units were placed in Brushy Creek to collect water samples for determination of SSC. The units collect samples every 14 hours for a two-week period, then samples are retrieved for analysis, and new sample bottles are loaded into the auto samplers. Sediment sampling has been in progress since January 2011 and will continue until November 2011. We measure sediment transport during dry, wet, and storm periods. Retrieved samples are brought to the laboratory where sediments are filtered and weighed to determine SSC. The SSC data have been evaluated along with records of rainfall events, as recorded by the UK Agriculture weather station located in Somerset, KY. Due to operational difficulties with our water and sediment samplers, we have only collected intermittent data, however, rainfall events seem to be correlated with increased SSC.

The Micro- and Macro- Faunal Diversity of a Devonian Dysaerobic Environment. LARRY TACKETT*, KARA WELLS, and CHARLES E. MASON, Department of Earth and Space Sciences, Morehead State University, Morehead, KY 40351.

This study examined the fauna contained in the type section of the Three Lick Bed of the Ohio Shale (Upper Devonian), which is located in Rowan County, Kentucky. The Three Lick Bed separates the underlying Huron Member from the overlying Cleveland Member of the Ohio Shale. The unit is 3.42 meters thick and is composed of three greenish gray shale beds separated by two intervening black shale beds. The three greenish-gray shale units were hypothesized to be deposited under dysaerobic conditions and thus the focus of this study. To date slightly over 200 kilograms of samples have been processed for macrofossils and 90 kilograms for microfossils. The samples were broken down using the kerosene technique and washed through a nested set of U. S. standard sieves, a #20 for macrofossils and a #100 for microfossils. The residue caught on the #100 sieve underwent heavy liquid separation and both the heavy and the light fractions were examined for microfossils. All picking, sorting, and identification of fossils were conducted under a binocular microscope. The results of this study support our hypothesis that the greenish gray shale units of the Three Lick Bed were deposited in a dysaerobic environment. Evidence supporting this conclusion includes the following: 1) a low diversity macro invertebrate fauna of 15 species, 2) of the 532 specimens identified nearly all were juveniles, 3) the fauna was dominated by mollusks, 12 out of 15 species, and 4) all macro invertebrates except *Lingula* were preserved as pyretic internal molds. Overall, benthic foraminifera dominate the microfossil fauna in both diversity and abundance, followed by ostracodes in terms of abundance. The macrofossil fauna is dominated by

ammonoids being the most diverse (with four species) and a low-spined gastropod being the most abundant (198/532).

HEALTH SCIENCE

Procedure for Preparing Purple Sweet Potato Powder. LINGYU HUANG*, CECIL BUTLER, and CHANGZHENG WANG, Human Nutrition Program, Kentucky State University, Frankfort, KY 40601.

Purple sweet potato has health promoting properties. Purple sweet potato powders currently on the market are made by grinding the raw material and sun-drying the precipitates, or grinding of sun-dried slices of the sweet potato. Recent research indicates that such processes lead to significant loss of antioxidants. Our objective was to develop a process that better preserves the antioxidants when the powders are produced. Purple sweet potatoes were obtained from a North Carolina farm. The whole sweet potatoes were steam-cooked at 200°F for 45 min before they were skinned and mashed. The mashed material was dried in a forced air-drying oven at 60°C or 80°C. After drying the materials were crushed and ground into powder in a Hobart grinder. Cooking of the whole sweet potato avoided the activation of enzymes so the damage of the antioxidants would be reduced. The drying process resulted in 71% loss of weight. The skin accounted for 4.5% of the total weight. The drying temperature was critical. At low temperature, the materials would spoil and mold would grow, rendering the materials useless. At high temperature (100°C), browning of the materials occurred potentially damaging the nutrients. Drying process did not significantly reduce the total phenolic content of the powder.

PHYSIOLOGY AND BIOCHEMISTRY

Regulation of EMT Proteins in Breast Cancer Cell Lines. MARY WIECHART*, JACKIE JANSEN, ARIELLE MARASLIGILLER, HILLARY RESTLE, SHANE MULVIHILL, STEFAN SIWKO, and JULIA CARTER, Wood Hudson Cancer Research Laboratory, Newport, KY 41071.

During 2011, 232,620 new breast cancer cases are predicted in the US and 39,970 breast cancer deaths. This high mortality rate is due to tumor metastasis. To metastasize, breast cancer cells must undergo epithelial-mesenchymal transition (EMT), a process that disaggregates the epithelium, reshapes it for movement, and requires biochemical re-programming. Slug and p21 activated kinase (Pak 1) are two proteins that are increased during EMT. Another protein, eukaryotic initiation factor 4E (eIF4E), is elevated in breast cancers. Elevated eIF4E function selectively enhances the translation of mRNAs with long, highly structured untranslated regions (UTRs) such as Slug and Pak 1. We hypothesized that elevated eIF4E function in breast cancer cells may enhance translation of Slug and Pak 1, thereby promoting EMT. To test this hypothesis we examined protein expression in western blots of lysates from 6 breast cancer cell lines with different estrogen, progesterone, and Her 2 receptor status. Since MDA 231 breast cancer cells

expressed all three proteins, are negative for all three receptors and are reported to be the most invasive breast cancer cell line, we used this cell line to determine if knock down of eIF4E by siRNA transfection would alter expression of these EMT associated proteins. We found a slight reduction in Slug expression in MDA 231 cells with reduced eIF4e but a slight increase in Pak 1 expression. Although these data are preliminary, they do not support our hypothesis that eIF4E regulates Slug and Pak 1 expression and possibly EMT in breast cancer.

Two Germline Variants of the *TGF β R1* Gene are Associated with Initiation, Progression and Clinical Outcome of Colorectal Cancer. HILLARY RESTLE^{*1}, SHANE MULVIHILL^{*1}, JONATHAN BENDER¹, KEVIN MURRAY¹, JESSICA SHAW¹, BRIANA VOGT¹, ROBERT SHIELDS¹, BRUCE COLLIGAN¹, JAMES DEDDENS², LARRY DOUGLASS¹, JAMES SCHAEFER¹, and JULIA CARTER¹, ¹Wood Hudson Cancer Research Laboratory, Newport, KY 41071, ²University of Cincinnati, Cincinnati, OH 45221.

Germline variations of transforming growth factor beta (TGF β) are associated with tumor initiation and progression, especially in bladder, breast, ovarian, kidney, and lung cancer. Colorectal cancer (CRC) is the second leading cause of cancer-related deaths in the United States. There will be over 140,000 people diagnosed with CRC this year and nearly 50,000 CRC related deaths. CRC is frequently diagnosed in the later stages due to the non-specific symptoms in its early stages, further emphasizing the need for genetic biomarkers. Two germline variants in the *TGF β R1* pathway were analyzed via capillary electrophoresis in 233 cases and 219 controls to determine if their incidence affected the prevalence and stage of cancer. We hypothesized that these variants could be significant factors in predicting initiation, progression, and growth in CRC. We found that patients with *Int7G24A*, a single nucleotide polymorphism in the intron 7/exon 7 boundary of the *TGF β R1* gene, had a significantly higher incidence of CRC as compared to non-cancer controls. *TGF β R1*6A*, a nine base pair deletion in exon 1 of the *TGF β R1* gene, was not associated with increased CRC incidence but was associated with adenoma patients that did not progress to advanced CRC. This suggests that *TGF β R1*6A* may have a protective effect. Patients with carcinoma-in-situ (CIS) or CRC stages 1-4 showed a significantly increased incidence of the *Int7G24A* variant as compared to non-cancer controls and patients who never progressed beyond adenoma. This discovery indicates that *Int7G24A* could be a biomarker for identifying patients at a higher risk for developing CRC.

SCIENCE EDUCATION

Sharing Ideas About Assessing Student Learning. JOHN G. SHIBER, Division of Nursing, Biology & Allied Health, Big Sandy Community & Technical College, Prestonsburg, KY 41653.

An emerging national policy of holding post-secondary educators more strictly accountable for student learning

has many scrambling to re-evaluate their teaching strategies and the assessment parameters they employ. It is an overwhelming challenge because, as colleges increasingly become like businesses and treat their students like clients, student attitudes toward learning are undermined by an equally strong if not stronger one of entitlement, irrespective of how much or little they apply themselves in their studies. This paper discusses the consequent need for an increased number of parameters, besides testing, to help assess student learning in the sciences such as those shown in studies by this investigator to be beneficial: pre-/post-testing, class attendance, in-class writing assignments immediately after reading articles or watching videos on scientific topics, active individual involvement and course-appropriate extra credit opportunities in and beyond the classroom, end-of-semester student opinion questionnaire on course, etc. An argument for establishing continuity among teachers within each science discipline to follow the same assessment guidelines will also be presented.

ZOOLOGY

Measurement of Differential Acid Concentration Along the Developing Gastrointestinal Tract of Tadpoles with an Improved pH Microprobe. SARAH E. CROSS, and RICHARD D. DURTSCHKE, Department of Biological Sciences, Northern Kentucky University, Highland Heights, KY 41099.

Digestion and assimilation of foodstuffs in vertebrates is often dependent upon changes in the chemical environment along the gut depending on the level of food decomposition and the optimality of conditions for enzyme activity. Low pH in the stomach can chemically breakdown food while activating pepsin protein enzymes. Other areas of the gut (e.g., colon) could show lower pH levels that would indicate plant fermentation and the release of volatile, short-chain, fatty acids. Measurements across developmental stages can document ontogenetic shifts in acid concentrations in the gut suggesting upregulation of digestive activities within the gastrointestinal (GI) tract. As free living vertebrates, tadpoles (anuran larvae) undergo developmental changes in the formation of the GI tract, but they are also consuming foods as might an adult vertebrate. Functional changes in digestive processes in tadpoles can therefore be responses to either maturation of the system or a response to the varied foods consumed. Previous research in our lab has shown changes in pH across the GI tract, suggesting digestive processes similar to adult vertebrates. Our continued investigations of differential acid concentrations along the gut has resulted in the design and fabrication of an improved pH microelectrode with a built-in micro reference electrode. We have been testing this new microprobe on locally collected Green frog (*Lithobates clamitans*) tadpoles, where after dissection, various regions of the GI tract were measured for changes in pH. In testing our solid-state microelectrodes with tip diameters of $\approx 10\ \mu\text{m}$ against standard pH solutions, we maintained precision of $R^2 = 0.95$.

Beyond mtDNA: Morphology and Nuclear Gene Flow Suggest Taxonomic Oversplitting in the Ringneck Snake *Diadophis punctatus*, FRANK M. FONTANELLA, Department of Biology and Chemistry, Morehead State University, Morehead, KY 40351.

Being able to efficiently and accurately delimit species is one of the most basic and important aspects of biology because species are the fundamental unit of analysis in biogeography, ecology, and conservation. This delimitation may be hampered by variation within and between populations making it difficult to determine whether populations have evolved into independent evolutionary units. Recently there has been a resurgence in species delimitation beyond traditional morphological and mitochondrial data that incorporates species distribution modeling and nuclear data to assess ecological divergence and levels of gene flow between populations. Using the Northeastern ringneck snake *Diadophis punctatus edwardsii* as a model, I expanded upon previous work by combining 24 external meristic characters from 300 museum samples, species distribution models generated from 19 climatic variables derived from 415 unique locality data points, and 10 microsatellite loci from 288 individuals, to test whether the mtDNA clades represent distinct evolutionary units. The PCA and CVA analysis of the meristic data failed to recover significant differences between the two mtDNA clades. Demographic analysis of the mtDNA data depicts rapid population expansion of the northern clade that corresponds to large areas of shared suitable habitat predicted by the species distribution models. Likewise, admixture analysis of the microsatellite data suggests high levels of nuclear gene flow between populations. When combined, these results suggest that the mtDNA clades are likely the result of historical divergence followed by contemporary gene flow. Moreover, this study highlights the importance of incorporating multiple lines of evidence for populations suspected of being cryptic species.

A Dissolved Oxygen Microprobe for Measuring Gut Anaerobic Fermentation in Developing Vertebrates. KATHERINE BACHMAN, KELSEY CARNAHAN, and RICHARD D. DURTSCHKE, Department of Biological Sciences, Northern Kentucky University, Highland Heights, KY 41099.

Food assimilation in organisms is important in the extraction of energy. Previous research by both our lab and others suggest anurans are herbivorous and detritivorous feeders. The extent to which cellulose breakdown and fermentation occurs in the GI tract is unknown. Studies done on pH in the GI tract of *Lithobates clamitans* has shown two major drops in pH, in the stomach and hindgut. The use of a dissolved oxygen microelectrode to measure oxygen levels in the gut would give us an idea of possible locations of cellulose fermentation and the possible existence of a colon. Over the past year, our lab has been working on building a dissolved oxygen microelectrode probe to measure these

levels. Assembly of these probes is comprised of four main components: the cathode, anode, electrolyte solution and outer casing. The cathode is a glass fused solid-state capillary tube, with a gold tip. The anode is silver wire coated in chloride ions. The outer casing is a glass pipette with a tip diameter of 10 micrometers and gas permeable membrane. The electrolyte is a mixed potassium chloride solution maintained at a high pH. These probes were calibrated with a high degree of accuracy and precision with rapid response times using standard concentrations of dissolved oxygen in water. Regression analyses against standard solutions have R^2 values in the range of 95%. Gastrointestinal tract samples were obtained from *Lithobates clamitans* and readings taken from 15 positions along the gut.

Amphibian Population Dynamics of a Rejuvenating Brown Field. JAMES 'MITCH' MERCER, and RICHARD D. DURTSCHKE, Department of Biological Sciences, Northern Kentucky University, Highland Heights, KY 41099.

The Lafarge Gypsum Plant, located in Silver Grove, KY, includes both secondary growth forest consisting of varied hardwood species and open wetland habitats. Just south of the Ohio River, grassland between the secondary forest and the riverbank supports vernal ponds, inundated with water during the spring. Approximately 5 cm of top soil exists due to the land that once served as a railroad yard, the underlying soil being permeated with rock. Determined a brown field during this stage development, chemicals due to industrial waste may remain on site despite rejuvenation efforts. Amphibians are especially susceptible to these environmental conditions as their moist skin facilitates a plethora of life processes. The study was conducted to analyze the ability of the site to sustain wildlife post-rejuvenation efforts. A comparative non-impacted wetland site (St. Anne Wetlands) approximately 2 km away was added to compare species thriving at either location. Various field techniques led to the capture of several species approximately every other day for a span of two years (during months of activity) to understand the dynamics of populations at either site. Species were marked to track migration between sites. Field sound recorders were implemented to track potentially unobserved species. Results suggest that the Lafarge site is able to sustain some reptile and amphibian species, however, several species, in particular salamanders, thrive at the St. Anne wetlands but have not settled at Lafarge.

JUNIOR ACADEMY OF SCIENCE ENGINEERING

Lubrication Efficiency of Oil Weights in Engines. GABRIEL L. M. WEBB-YEATES, Bowling Green High School, Bowling Green, KY 42101.

Engine oils have different weights such as 5W-30 and 10W-30. Each oil weight has a different viscosity and lubrication ability. High weight oil is more viscous. Clean oil should be less viscous than used oil. My hypothesis is that lower weight oils will lubricate better at cold

temperatures. Clean oil should lubricate better than dirty oil. The relative viscosity of different weights of oil from the same manufacturer increased for heavier weights. For the same weight of oil from different manufacturers, the relative viscosity is similar. Used engine oil was more viscous. Lubrication ability was measured by putting a fixed volume of oil between two metal plates placed on a self-manufactured adjustable inclined plane. The height of the inclined plane when the top metal plate starts to slide or slip over the bottom plate was used to measure relative lubrication. Engine oil of the same weight from

different companies was measured. Different weights of oils from the same company were measured. Both clean and used oil of the same weight were measured to see if lubrication changes as the oil becomes dirty and used. The inclined plane worked well with good consistency in the slip point height. For the same manufacturer, the lightweight 5W-30 oil lubricated better at cold temperatures than heavy weight oils. Clean oil lubricated better than dirty oil. Surprisingly, high mileage engine oil, which will stick to metal parts better, had a higher slip point than other oils of the same weight.



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