



Impacts and Reports

Agricultural Research Station



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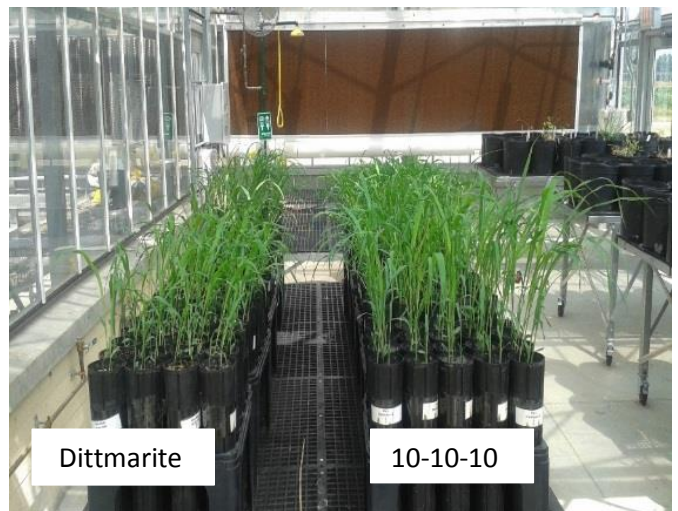
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Evaluation of Dittmarite as a Fertilizer for Plant Growth

Who cares and why? The environmental impacts of phosphorus and nitrogen that enrich algae growth are well known. The sources of phosphorus (P) and nitrogen (N) (nutrients) vary. The main contributors to the eutrophication of surface waters, estuaries and lakes are: confined animal feeding operations, land application of animal manure and chemical fertilizer on agricultural land, and municipal as well as industrial wastewaters. Solutions to this dilemma is on-site treatment of wastewater from high-volume fish producers, confined animal operators (CAFO), and domestic septic systems in rural homes to remove these nutrients.

What has the project done so far? Dittmarite ($\text{MgNH}_4\text{PO}_4\cdot\text{H}_2\text{O}$) recovered from wastewater or synthesized from off-the-shelf chemicals was evaluated as a source of N, P and Magnesium (Mg) in a greenhouse study using sorghum (*Sorghum bicolor*) as a test crop. Plants were grown under optimum conditions with humidity control. Watering was done as needed after soil moisture determination. The potential for dittmarite to serve as a value-added product was compared with a 10-10-10 (N-P-K) fertilizer to supply these macronutrients to the plant. Minimal research has been conducted to evaluate dittmarite as a fertilizer additive, albeit several studies have shown promising results for struvite, the hexahydrate form of dittmarite.

What research is needed? Solubility tests in the laboratory indicated that dittmarite is more soluble than commercial 10-10-10 fertilizer. There were no significant differences in plant dry matter production or total phosphorus uptake at greenhouse conditions, and both dittmarite and the 10-10-10 fertilizer generally performed similarly to one another. However, micronutrients may need to be supplied to ascertain that there are “hidden hunger effects” during the growth period. These findings support previous work that showed recovered waste products are effective fertilizer sources, and it also provide evidence that dittmarite may have economic value to farmers as a value-added nutrient supplement to commercial fertilizers.



Want to know more? Contact Dr. Asmare Atalay, aatalay@vsu.edu

This project has been supported by a USDA-NIFA 1890 Institution Capacity Building Grant.

USDA-Foreign Agricultural Service and Virginia State University Assist "Feed the Future" Program in Guatemala via Enhanced Pigeon pea Productivity

Who cares and why? The U.S. "Feed the Future (FTF)" program has the overarching goal of sustainably reducing global poverty and hunger. Guatemala has been identified by the FTF as a candidate country. Virginia State University's pigeon pea (*Cajanus cajan* (L.) breeding program (Dr. Harbans Bhardwaj served as Principal Investigator) selected this food legume crop to help reduce hunger and to improve food production in Guatemala. Pigeon pea (known locally as GANDULE) has a long history of production in Guatemala. However, pigeon pea yield level in Guatemala is quite low (~ 400 pounds/acre).



Project team (L-R): Henry Dinael, Hugo Zurita, Michelle Corley, Reza Rafie, Harbans Bhardwaj, Edras Tesucun, and Rafael Dubon

What has the project done so far? Dr. Bhardwaj provided 100 pigeon pea breeding lines to the Guatemalan cooperator (Mr. Hugo Zurita). These lines were planted at three locations in Guatemala during 2015 and 2016 to identify high-yielding lines for commercial production in Guatemala. This project was a great success. One breeding line (#91), when grown in Petén region, yielded approximately 2100 pounds per acre as compared to traditional yield of about 400 pounds per acre. This entry was multiplied in 2016 and 2017 in Guatemala in order to distribute seed to all interested farmers with the assistance of the Guatemalan Ministry of Agriculture.

What research is needed? Further research is needed regarding continued pigeon pea breeding in Guatemala to increase yield; identification of suitable bradyrhizobial strains to utilize Symbiotic N fixation; and characterization and improvement of nutritional quality. Furthermore, training of local extension personnel for outreach activities is needed.



VSU investigators in a farmer's field in Guatemala where pigeon pea breeding line #91 was being multiplied during 2016.



Pigeon pea dry seeds contain ~ 24 % protein



Pigeon pea green seeds contain ~

Want to know more? Contact Dr. Harbans L. Bhardwaj, hbhardwaj@vsu.edu

This research was funded by USDA-FAS through the Scientific Cooperation Research Program (SR-CR-14-001).

Impact of Stinging Nettle on Gastrointestinal Parasite Control in Meat Goats

Who cares and why? Small ruminant farmers continue to struggle with gastrointestinal parasitic infection and anthelmintic resistance. As a result, the industry strives to curb economic losses due to the gastrointestinal blood-fed parasite, *Haemonchus contortus*. To succeed in small ruminant production, farmers can benefit from high-protein, natural bioactive/anthelmintic alternative feeds such as Stinging Nettle (SN) to aid small ruminants during infection by *Haemonchus contortus*. Stinging Nettle has been shown to curb anemia, and has many medicinal properties, including anti-hemorrhagic, anti-inflammatory (stems and leaves), antioxidant, hypocholesterolemic, antiviral, antibacterial, antifungal, anthelmintic, anti-diabetic, and anti-cancer activities. It is also known for causing worm expulsion from the GI tract. These concerns are ultimately linked to aid small ruminant meat goat farmers to enhance goat meat (Chevon) consumption by marketing enhanced value-added heart healthy red meat.

What has the project done so far? Researchers have looked at the effect of SN on Inflammatory biomarkers (C-Reactive Protein, TNF -Alpha, Interleukin 6, Interleukin 5), blood volume/ anemia status (Packed Cell Volume (PCV)) during infection, cholesterol gene expression (APOA,B), host gastrointestinal repair gene expression (TFF 1,2,3) and anthelmintic effect on parasite load (Fecal Egg Counts (FEC)) in meat goats. Goats were pre-screened for initial parasite load and anemia status and fed either of three diets (0, 25% and 75% SN supplemented) for 52 days (Figures 1 and 2). Parasite load and anemia status were monitored biweekly. Biomarker gene expression was determined via quantitative Real-Time PCR (polymerase chain reaction). Stinging Nettle reduced ($P < 0.05$) the need for expression of GI repair Genes (TFF3), increased ($P < 0.05$) blood volume/PCV, decreased ($P < 0.05$) inflammation, reduced ($P < 0.05$) cholesterol gene expression, and reduced ($P < 0.05$) gastrointestinal parasite load/FEC in meat goats infected with *Haemonchus contortus*.

What research is needed?

1. Isolation and evaluation of the natural anthelmintic /bioactive compound in Stinging Nettle
2. Evaluation of Stinging Nettle on reduction of cholesterol in Chevon (goat meat)
3. Evaluation of other potential natural anthelmintic alternative feeds for meat goats

Want to know more? Contact Dr. Michelle Corley, mcorley@vsu.edu

This project was supported by Evans-Allen formula funds from USDA-NIFA.

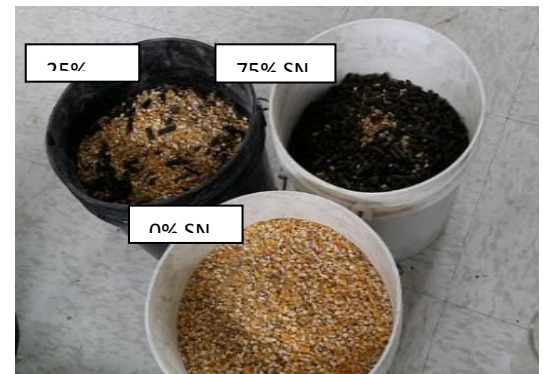


Figure 1. Stinging Nettle Diets



Figure 2. Goat Consuming Stinging Nettle Diet via

Development of Edamame and Specialty Soybeans: A Profitable Option for Rural and Urban Agriculture in Virginia

Who cares and why? Virginia State University (VSU) has established a vegetable soybean (edamame) research program and released three varieties, 'Asmara', 'Owens', and 'Randolph'. To facilitate the use of these varieties, VSU scientists have investigated agronomic practices to expand the harvest-window for fresh beans. However, these lines have not been grown on a commercial scale due to some unsatisfactory traits, such as small seed size and lodging of plants. Therefore, genetic improvement of edamame by breeding and selection is continuing. In addition to edamame, conventional food-grade specialty soybeans have been integrated into the research program.

What has the project done so far? Re-selection of individual plants and breeding lines has been performed for three years. During 2015-2016, hundreds of breeding lines were evaluated for agronomic performance, yield and nutrients (seed protein and oil). Promising lines have been selected for further purification and seed multiplication. Unique edamame and specialty soybean genotypes were introduced, and new crosses were made to develop segregating/breeding populations for selection. Collaboration with USDA-ARS had been initiated by planting the United Soybean Board Diversity Trials. As partners and co-organizers,



we also hosted the Southern Soybean Breeders Tour in 2016. Evaluation, seed purification and increase of superior lines are in progress, and hopefully some new superior cultivars and elite germplasm lines can be released in the next few years.



What research is needed? To meet the need for superior varieties, future research will focus on: (1) Evaluation and selection of breeding lines for yield and quality characteristics of edamame and grain, (2) Further purification and increase of superior lines/varieties for release, and (3) Development of breeding populations integrated with high yield potential and high-quality traits for edamame and specialty/food-type uses. There is also need to address post-harvest processing, storage and marketing of edamame and specialty soybeans.

Want to know more? Contact Dr. Guo-Liang Jiang, gjiang@vsu.edu

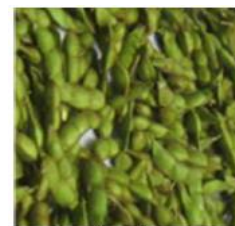
This project was supported by Evans-Allen formula funds and by 1890 Institution Capacity Building Grant from USDA-NIFA.

Edamame-Superfood: Improving Quality by Reducing Microbial Spoilage

Who cares and why? Edamame is a large-seeded green vegetable soybean. Americans consume approximately 25,000 to 30,000 tons of edamame, most of which is imported from Asia as a frozen product. However, restaurants and wholesale outlets prefer to purchase fresh edamame. A small amount of edamame crop in the U.S. is produced in the West and Upper Midwest regions and recently, it is emerging as a promising cash crop for Virginia farmers. The reported health benefits of edamame and its characterization as a “superfood” have contributed to its rise in popularity among American consumers, creating a potential niche market for small scale producers. The 2014 market for edamame was valued at approximately USD \$175 to \$200 million.

However, there are challenges in marketing edamame because of its narrow harvest window and a short shelf life. In addition, edamame is highly perishable, and the greatest challenge to its further commercialization is prolonging post-harvest shelf-life and to minimizing the physicochemical and microbial deterioration that causes degradation of its color, texture, and flavor. Several studies have found no conventional washing methods capable of reducing microbial populations by more than 90 to 99 percent (1 to 2 log).

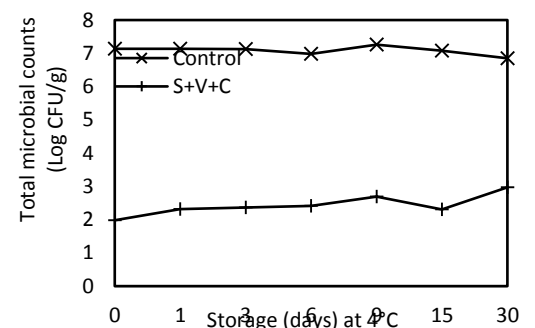
What has the project done so far? Scientists at Virginia State University have successfully developed three edamame cultivars that are suitable to Virginia growing conditions (Asmara, Owens and Randolph) which have been registered with USDA. The current study investigated the use of the combination of steam blanching (S), vacuum packaging (V) and cold storage (C) for prolonging the physical and microbiological quality of edamame. Steam blanching for 30 sec at 90°C did not significantly change the hardness of whole pod. The green color intensity of edamame significantly increased by 32%. Steam blanching of whole pods significantly reduced the total counts of aerobic mesophiles (> 5.1 log CFU/g), yeasts and molds (> 4.3 log CFU/g), and psychrotrophs (> 4.0 log CFU/g), with no significant increase in overall microbial counts during 4°C refrigeration for nine days. Overall, use of the combination treatment showed consistent and significant reduction of microbial counts with no significant effects on physical quality.



Day 0



Day 30 after treatment



Impacts

- Identified a treatment that reduced microbial counts while maintaining physical quality
- Trained a graduate student, two dietetic interns and one undergraduate student
- Research findings have been disseminated through a peer-reviewed journal

Want to know more? Contact Dr. Chyer Kim, ckim@vsu.edu

This project was supported by the Evans-Allen formula funds from USDA-NIFA.

Industrial Hemp Research and Impact on Producers and Industry Participants Interest

Who cares and why? Research is underway on industrial hemp (*Cannabis sativa L.*) at Virginia State University (VSU). More than 70 years of being classified as a drug and banned as a crop in the United States of America (USA) has created a knowledge gap on this crop. The push in recent years for legalization of industrial hemp production is due to appreciation of its multiple uses and potential to improve the economies of farmers in the Commonwealth of Virginia and elsewhere in the United States. Beside producers, several industries including pharmaceutical, food, and fiber industry are seeking alternative sources of raw material that produces high quality products for better returns. With its versatility, industrial hemp is gaining significant recognition from several industries due to the quality of its products. Recent field studies have stimulated a lot of interest and the magnitude of attendees to a recent field-day and questions asked while seeking more information on industrial hemp, are strong indications of potential adoption of the crop, and processing plant establishment if and when it is fully legalized.



What has the project done so far? The project has focused on several agronomic aspects of industrial hemp under climatic conditions in Chesterfield, VA. Researchers have conducted a nitrogen fertilizer response study and a variety trial to evaluate performances and productivity of several foreign-developed grain and fiber-type industrial hemp varieties have been carried out. A study on optimum planting dates was also initiated to compare establishment and performances of different varieties from early spring through early summer. Results so far have shown that growth responses and yield potentials differ significantly depending on the planting date. In general, early planting (mid-April) leads to poor emergence and low plant populations. Planting in early- and mid-May when soil temperatures are higher resulted in improved plant emergence, increased plant density, and a more vibrant and robust crop. Rapid crop growth due to improved conditions led to quick crop canopy establishment which reduced weed competition for nutrients, water and other resources. This crop showed a greater potential for high grain and fiber yield. For late planting (early- and late-June), there was greater risk of moisture stress as temperatures rises and precipitation reduced. Lack of sufficient soil moisture reduced both crop growth and canopy establishment and allows for increased weed competition.

What research is needed? While the results on establishment and performance of industrial hemp are preliminary, there are strong indications that a number of foreign-developed varieties have production potential in the Commonwealth of Virginia. However, further research must be completed before definitive answers on viability of this crop are obtained. Studies are needed to gather, data on pest and disease infestation and possible remedial measures - the economics of production to determine its profitability, market opportunities and potentials, and competitiveness against established crops that offer similar products.

Want to know more? Contact Dr. Maru K. Kering, mkering@vsu.edu

This project was supported by Virginia Department of Agriculture and Consumer Services (VDACS) Grant.

Small Ruminant Health: Gut Microbes and their Interactions

Who cares and why? Small ruminant producers experience losses mainly due to disease conditions associated with gastrointestinal health, especially in young growing animals. The causative agents involved have not yet been fully characterized, but are thought to be an interaction between microbial and parasitic agents. Identifying microbial structures in the gut over time since birth will help to identify (a) the critical periods where interventions are needed, (b) specific pathogen/parasites involved and (c) changes in beneficial commensal bacteria dynamics over time. This information will be used to advise producers on best management protocols to reduce losses and also advance further research on intervention methods.

What has the project done so far?

- Isolated E.coli and lactic acid bacteria (beneficial microbes) from healthy and diarrheic animals' fecal samples. Preliminary results using growth morphological characteristics indicate the lactic acid bacteria diversity in the growing ruminant is dynamic, and the predominant populations differ over time as well as between young animals and adults.
- Preserved isolates for further screening and characterization.
- Extracted DNA from some of the E.coli and lactobacillus isolates from these animals and their products for further molecular characterization.
- Screened some of the E.coli isolates from pre-weaned animals for antimicrobial resistance profiles. Preliminary findings indicate that even in the absence of the use of antibiotics in these animals, the developing small ruminant gut is a host and reservoir of E.coli with antimicrobial resistance that potentially could contaminate the environment. How this occurs remains a subject for further research.



What research is needed?

- Characterize microbial and parasitic diversity and dynamics over time using molecular analysis in the frozen samples. Screen E. coli isolates for virulence genes, public health relevance and antimicrobial resistance profiles and genes.
- Characterize the gut lactobacillus isolates-diversity, dynamics over time, antimicrobial resistance and potential health and performance benefits.
- Collect fecal samples from the weaned animals at six months and one year to further characterize gut microbial dynamics.
- Expand animal health research to involve small ruminant producer farms, abattoirs and livestock auction sites.

Want to know more? Contact Dr. Eunice Ndegwa, endegwa@vsu.edu

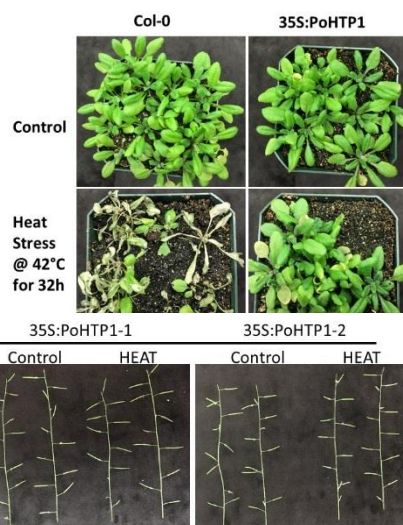
This project was supported by Evans-Allen formula funds from USDA-NIFA.

Purslane as a Potential Resource for Improving Crop Productivity under Heat Stress

Who cares and why? With the current trend of global climate change, the duration and frequency of extreme heat events are increasing. In fact, the first 16 years of the 21st century were the hottest years on record. The elevated temperatures, especially during the summer, exert significant heat stress on most crop species. Such stress has already caused significant yield loss in many crops and further yield reduction is expected in the future. Accordingly, genetic improvement for heat tolerance among staple crops is critical to sustainable agricultural production in the coming years. However, genetic variability in major crops is limited and exploring new resources for heat tolerance is essential to improve crop heat stress tolerance. Purslane (*Portulaca oleracea*) is a xerophyte adapted to many hostile environments, including very hot climates. Such unique species hold great potential as sources of novel genes that can be used to improve heat tolerance in crops.

What has the project done so far? At Virginia State University, research was conducted on a comparative genomic study of purslane in an effort to identify novel genes for crop heat tolerance improvement. A potential candidate, HTP1 (for Heat Tolerance Phenotype 1), a homologous gene associated with programmed cell death, was highly expressed in response to heat stress. Researchers successfully cloned the full length cDNA from purslane and consistently overexpressed it in *Arabidopsis thaliana*. Independent transgenic *Arabidopsis* plants showed significant heat tolerance at the vegetative, and reproductive growth stages. The confirmed strong heat tolerance phenotype in *Arabidopsis* makes the Purslane HTP1 gene a great candidate for use in improvement of crop tolerance to heat stress.

What research is needed? Given that the PoHTP1 gene showed significant heat tolerance in *Arabidopsis*, the plan is to transfer it into corn and soybean to see if it can be used to improve heat tolerance in both monocot and dicot crops. Furthermore, there is a plan to use transcriptome analysis to elucidate mechanisms responsible for HTP1-mediated heat tolerance in plants.



Impacts

- The novel gene PoHTP1 from purslane may provide a new strategy to improve crop heat tolerance.
- Mechanisms of PoHTP1-mediated heat tolerance will deepen our knowledge regarding how plants defend against heat stress.

Want to know more? Contact Dr. Shuxin Ren, sren@vsu.edu

This project has been supported by Evans-Allen formula funds from USDA-NIFA.

Finding an Alternative to Tobacco in Southside Virginia

Who cares and why? Parts of Southside Virginia that used to rely on tobacco as a cash crop before the quota buyout of 2004 are still struggling to identify an alternative crop. In particular, small, limited-resource farmers struggle because they lack the acreage and resources to grow corn and soybean for the grain market.

What has the project done so far? Virginia State University (VSU) with support from the Virginia Tobacco Region Revitalization Commission (TRRC) has been working to develop edamame-based agribusiness as an alternative to tobacco in affected counties. The project has invested more than \$250,000 in harvesting and processing equipment and facilities to be used by small farmers. The project recently purchased two ASA-Lift CB1000 harvesters whose versatility will facilitate recovery of not only edamame, but also Lima, butter and string beans. Researchers are also working with partners to explore opportunities for value-addition and to develop a market for secondary products.



What research is needed? The project's most significant challenge thus far is managing harvest, postharvest and marketing logistics to ensure that growers can deliver high-quality fresh products to the consumer. Researchers are working with other stakeholders, including the Virginia Department of Corrections, to explore various postharvest handling approaches such as flash freezing to extend shelf-life.

Impacts

- Worked with more than 30 small, limited-resource, and socially disadvantaged farmers over the last six years.
- Built linkages with state, non-profit, and private sector entities to develop edamame-based agribusinesses in Southside Virginia.
- Helped establish a market and consumer base for edamame in the region.
- Reached more than 100 stakeholders through field days and other public education events.

Want to know more? Contact Dr. Laban Rutto, lrutto@vsu.edu

This project has been funded by the Virginia Tobacco Region Revitalization Commission (TRRC). The most recent grant is award 3111 entitled "*Establishing a pipeline for postharvest processing, handling, and marketing of frozen edamame in Southside Virginia.*"

Hops (*Humulus lupulus*) Research in the Mid-Atlantic

Who cares and why? A growing craft beer industry in Virginia and the mid-Atlantic has created opportunities for farmers to supply ingredients used in brewing. Among them, hops (used for bittering and aroma in beer) has attracted the most attention. Growers are seeking research-based information on varieties suited to the region, agronomic practices including pest and disease management, and postharvest handling of the crop. Similarly, brewers require reliable data on quality and chemistry of locally grown hops.



What has the project done so far? At the Virginia State University's Agricultural Research Station, researchers have built a research hop yard and established experiments to:

- Evaluate different hop varieties,
- Determine nutrient and irrigation requirements,
- Observe pest and disease interactions under Virginia conditions.

A multi-location evaluation of five popular varieties (involving two cooperating farms) is also underway and the program is working to establish a state-wide pest and disease forecasting system.

What research is needed? Further research is needed to identify hops varieties that can be grown by farmers in the mid-Atlantic. There is also a need to define agronomic benchmarks for the region, to recommend interventions for dealing with common pests and diseases, and to identify cost-effective postharvest handling solutions for small growers.

Impacts

- The research hop yard has attracted significant stakeholder interest and support, hosting more than 500 visitors since it began operation two years ago.
- Linkages with growers have been established to leverage resources in support of the hops industry.
- Critical data have been collected on varietal performance and pest/disease interactions.

Want to know more? Contact Dr. Laban Rutto, lrutto@vsu.edu

This project has been supported by a block grant from USDA-NIFA through the Virginia Department of Consumer Services (VDACS) and an 1890 Institution Capacity Building Grant #2015-38821-24384, and Evans-Allen formula funds from USDA-NIFA.

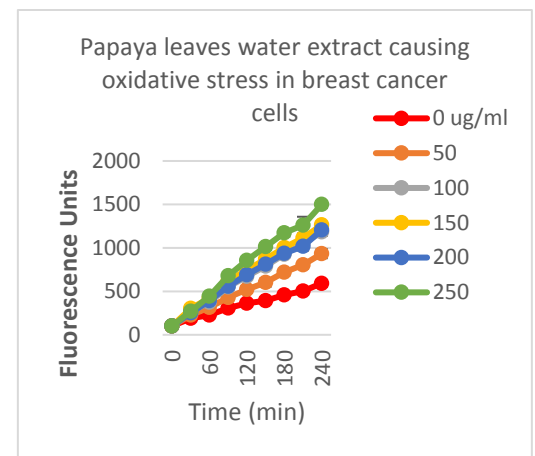
Papaya, Ginger, Turmeric: Specialty Crops for Reducing Chronic Diseases in Virginia

Who cares and why? According to *The State of Obesity: Better Policies for a Healthier America* published in September 2016, Virginia's obesity rate is the 29th in the nation. Obesity is one of the leading contributory factor in developing other chronic diseases including diabetes, cardiovascular disease and cancer. Cancer is the leading cause of death in Virginia, and second leading cause of death (after heart disease) in the United States.

Modern science has discovered that most food contains effective disease preventive biomolecules that can improve our health and reduce our risk for many diseases including obesity, diabetes, cardiovascular diseases, cancer, poor bone health, and neurological diseases. Currently consumers are looking for food to prevent and treat these chronic diseases. At Virginia State University (VSU) scientists are investigating beneficial effects of fruits, vegetable and spices including papaya, ginger, and turmeric for preventing and/or treating chronic diseases.

What has the project done so far? Study results show:

- Papaya seeds possess wound healing activity and have a potential to be used for caring diabetes wounds.
- Papaya leaves contain anti-cancer activity for breast, colon, and leukemic cancers whereas papaya seeds possess anti-cancer activity for prostate cancer.
- Ginger contained 6-gingerol and shogaol which possess potential activities for obesity that can effectively be used for reducing obesity in Virginia.
- Turmeric contains active component curcumin which has strong anti-inflammatory activity and anti-cancer activity for breast cancer.



What research is needed?

- Investigate the potential of papaya leaves extract as an adjunct therapy to improve the efficacy of currently prescribed anticancer drugs and their potential for lowering the risk of obesity and diabetes.
- Study the cellular and molecular mechanism of papaya leaves extract the in prevention/treatment of chronic diseases like obesity, diabetes, and cancer.
- Determine the phytochemical profile of different varieties of ginger and turmeric during various cultivation conditions and post-harvest treatments and to determine the mechanism for their preventive effects on obesity and cancer.

Want to know more? Contact Dr. Rafat Siddiqui, rsiddiqui@vsu.edu

This project was supported by Evans-Allen formula funds from USDA-NIFA.

What Goats Might Say About Eastern Gamagrass in Virginia!

Who cares and why? Summer forage shortages (summer slump) and gastrointestinal nematode (GIN) infections are two major constraints impacting small ruminant production, in Virginia and other southeastern states. Forage shortages may impact animal growth rates and or make them more susceptible to diseases thus causing losses in product quantity and quality. Moreover, feeding usually constitutes the largest proportion of variable costs of livestock production - therefore, improving summer forage production is a necessary step for small producers to benefit from the rapidly growing demand for meat goats and related food products in the mid-Atlantic region. However, the prevalence of GIN infections, resistance to chemical anthelmintics and consumer concerns about drug residues in food products have increased demand for forage-based strategies to control parasites affecting small ruminants.

What has the project done so far? At Virginia State University (VSU), researchers are evaluating the reliability of gamagrass and bio-active forage mixtures for improving profitable forage-based meat-goat production in Virginia. It is assumed that, this highly palatable, tall-growing, and leafy native grass will provide dependable high-quality forage biomass during summer and at high foraging heights so animals can avoid eating too close to the ground where parasite larvae are mostly found. Gamagrass which mixes well with other tall-growing forage species is also less prone to trampling damages during grazing.



Fig 2. Goats enjoy nutritious tall-grow



Fig 1. Research student collects pre-grazing data



Fig 3. Dr. Vitalis Temu assesses gamagrass establishment at Mr. Mike Winn's Carraway Farm in Stony Creek, VA.

What research is needed? Address weed control challenges during establishment and strategies for appropriate defoliation management.

Want to know more? Contact Dr. Vitalis W. Temu, vtemu@vsu.edu

This project was supported by Evans-Allen formula funds from USDA-NIFA.

Improving Pasture-Based Lamb Production for Direct Marketing

Who cares and why? A comprehensive review of the U.S. sheep industry by the National Research Council identified forage-finished lamb and direct marketing of high quality, lighter weight lambs to expanding niche and ethnic markets as key opportunities to improve the sheep industry's efficiency and competitiveness. A report commissioned by the American Sheep Industry Association indicated that the greatest potential for expansion lies primarily in non-traditional markets using alternative breeds, such as hair sheep. This project evaluated the effect of crossbreeding and agro-byproduct supplementation in a pasture-based lamb production system on growth rate, lamb fitness and carcass quality and composition.

What has the project done so far? Grazing trials were conducted at different times of the year using purebred and crossbred (Dorset-sired) Landrace hair sheep lambs from Barbados Blackbelly and St. Croix ewes managed under an accelerated lambing system. Lambs rotationally grazed cool and warm season forages dependent on time of year, and were individually supplemented using a Calan© feeding system. Under summer grazing conditions soy hull supplementation at 2% of body weight increased growth rate by 130% over pasture-only lambs, and growth rates in crossbred lambs by 24% compared to purebred lambs. During spring grazing of fescue pasture, no differences were observed between soy hull and corn gluten feed supplements, but supplementation increased growth rate by 75% and crossbreeding by 32%. Lambs removed from soy hull supplementation at 21 intervals before harvest during late fall and winter grazing of stockpiled fescue and annual ryegrass had lower weights, dressing percentage and loin eye area. Parasite burden was reduced in supplemented lambs, but was not different between purebred and crossbred lambs. Consumer taste testing indicated that pasture-only, crossbred ground lamb was rated least desirable. Fatty acid profiles in fat depots from pasture-only lambs were considered healthier than those of supplemented lambs.



What research is needed? Findings from this projects will be used to design a system of semi-continuous lamb production on pasture, using warm and cool season annual and perennial forages. Lambs will be produced under accelerated mating using a dual ewe flock system lambing in four-month intervals, and lambs placed into grower flock for continuous harvest at designated target weights.

Impacts

- Improvements in growth rates were more pronounced due to supplementation than crossbreeding.
- Crossbred lambs showed more signs of gastrointestinal parasitism during seasonal peaks in pasture infectivity than purebred lambs, but supplementation greatly mitigated these effects.
- Benefits of crossbreeding were most pronounced under conditions of optimal pasture quality in association with supplementation.
- Fatty acid profiles were more favorable in lambs when raised on pasture-only, but were not significantly affected by breed type.

Want to know more? Contact Dr. Stephan Wildeus, swildeus@vsu.edu

This project was supported by a USDA-NIFA 1890 Institution Capacity Building Grant.

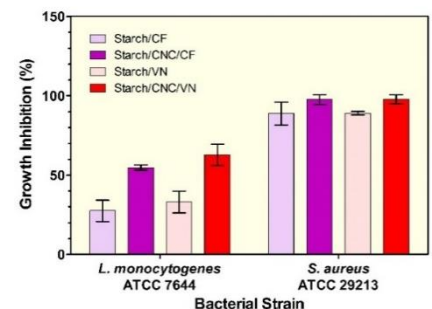
Starch Active Nanocomposite Films and their Antimicrobial Effectiveness on Ready-to-Eat Chicken Meat

Who cares and why? Food safety is a principal concern of the food industry. For many refrigerated food products, microbial contamination occurs primarily at the surface. Antimicrobial food packaging, an active packaging created by incorporating antimicrobial agents directly in the packaging matrix, is an innovative and efficient post-processing strategy that minimizes the level of pathogenic microorganisms in food products. Antimicrobial packaging films function as carriers for antimicrobial agents, which could diffuse into the contained food to control microbial contamination. Combining antimicrobial agents with nanocomposite film is particularly desirable since nanofillers improve the structural integrity and barrier properties of starch-based biodegradable film. The use of grape pomace extract as a naturally-occurring antimicrobial agent and biodegradable nanocrystals derived from crop by-products or agricultural wastes can improve food safety.

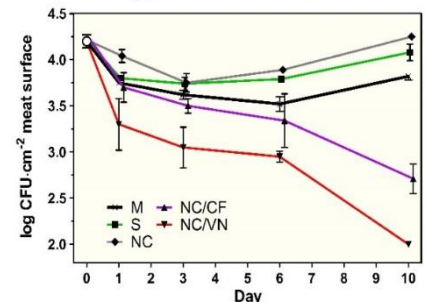
What has the project done so far? Research was done to: (1) prepare and characterize starch active nanocomposite films by incorporating cellulose nanocrystal (CNC) and two grape pomace extracts (GPE): Cabernet Franc (CF, red variety) and Viognier (VN, white variety); and (2) apply the films to ready-to eat (RTE) chicken meats to evaluate their antimicrobial properties. Incorporation of CNC significantly increased the films tensile strength (TS) and decreased their elongation at break (%E) and water vapor permeability (WVP). GPE had a compensatory effect on the mechanical properties and the WVP. The films with VN and the presence of CNC led to higher amounts of phenolic compound release. The films containing GPE exhibited a stronger inhibitory effect on *S. aureus* (ATCC 29213) compared to that of *L. monocytogenes* (ATCC 7644). Further application of the films on RTE chicken meats indicated that starch/CNC/VN films was most effective against *L. monocytogenes* when inoculated on the meat samples during the 10-days storage period at 4 C.

What research is needed? Future studies will focus on the ability of starch nanocomposite film containing Viognier GPE to inhibit growth of bacteria and on the antioxidant activity of the films.

Antimicrobial Activity of Starch Films



Bacterial Growth Inhibition Following Application of Starch Films



Impacts

- Benefits to local grape producers and the wine industry.
 - Value-added utilization could increase profits to grape and wine producers
 - Reduction in disposal costs and volume of waste stream
- Benefits to food, meat, and other industries
 - Use natural compounds in their products
 - Reduce consumer risk and concerns about synthetic compounds

Want to know more? Contact Dr. Yixiang Xu, yixu@vsu.edu

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Meat Quality of Growing Goats as Influenced by Dietary Protein and Gastrointestinal Nematode Challenge

Who cares and why? Goat production increased by about one-third in the past decade in the U.S. due to growing demand for goat meat from specialty markets. Demand is expected to continue to grow as a result of changing demographics. Nutrition and parasites play a special and essential role in meat goat production. Meat goats' nutritional status is influenced by diet protein level and infection by the gastrointestinal nematodes (GIN) parasite, of which *Haemonchus contortus* (HC) is the most important. Feed costs incurred to provide necessary nutrients in the feedstuffs goats consume is the major expense in meat goat production. The effects of protein nutrition and its interaction with GIN parasite infection and meat quality is less studied in goats than in sheep. Goats are more susceptible to parasitism than sheep because natural resistance develops later in life. Improvement in protein nutrition can enhance an immunologic ability to regulate the GIN population and its negative effects while maintaining reasonable levels of production.



What has the project done so far? Research was conducted with intact male bucks to study the effects of parasite challenge and diet protein level on animal clinical parameters, performance, and meat quality. The study results showed that dietary protein level influenced the establishment of *H. contortus* in growing meat goats. Higher protein level improved the animals' resistance and resilience and also enabled the goats to cope with some of the undesirable consequences of parasitism such as loss of weight and lowered animal performance. By contrast a low-protein diet made the animal more vulnerable to HC infection and adversely affected its performance. Meat quality traits like crude protein, fat content and meat tenderness remained unchanged which are important considering the contribution of fat and protein to the nutritional value of meat. Such an effect could be significant in field conditions, where suboptimal nutrition commonly occurs. Improving resistance and resilience against GI parasitism through supplemental dietary protein could improve production performance against protein deficit animals.



What research is needed? Explore role of feed energy level together with dietary protein levels and possible interactions on animal performance and meat quality characteristics in a larger population of meat goats and sheep. Further research should also include the impact on lifetime productivity.

Impacts

- Increased protein level in diets improved immunity (resistance and resilience) of the goats against GIN parasite infection that may reduce cost of chemotherapy.
- Higher dietary protein level improved performance and did not negatively affect product quality (meat).

Want to know more? Contact Dr. Adnan Yousuf, ayousuf@vsu.edu

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