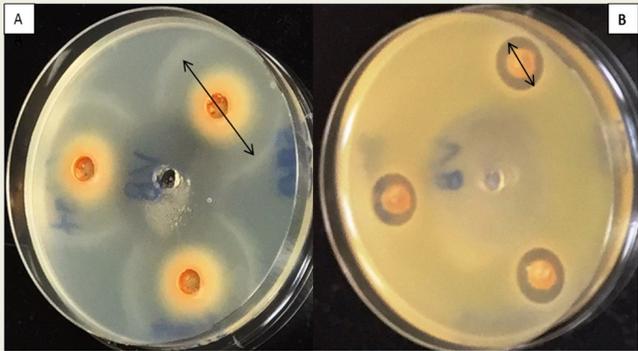


IMPACTS 2016

Agricultural Research Station

Virginia State University



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This report was compiled and edited by Roz Stein.

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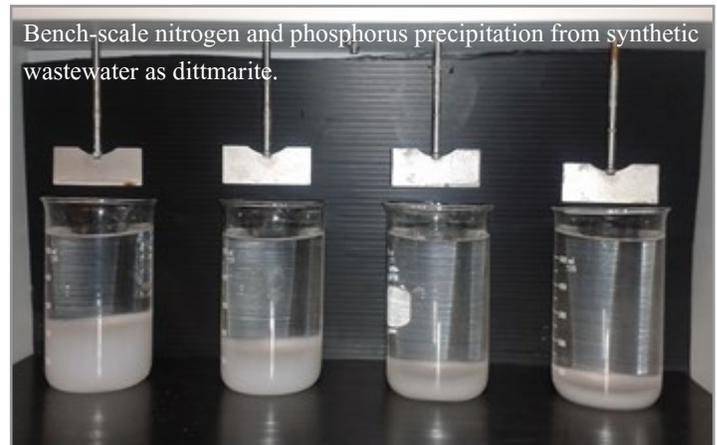
Simultaneous Removal of Nitrogen and Phosphorus from Municipal Wastewater

Who cares and why?

Municipal wastewater treatment plants are in the business of removing toxic chemicals from domestic wastewater. After being properly treated, wastewater is disposed of into rivers that then empty into bays and estuaries, which are sensitive to certain types of chemicals. Among those chemicals considered toxic to aquatic life are nitrogen (N) and phosphorus (P). The overabundance of N and P in bays, rivers and lakes is a process called eutrophication that directly impacts fish and other aquatic life through algae bloom and depletion of oxygen in water. It is therefore critical that the methods used by municipal wastewater treatment plants are able to efficiently remove these chemicals to extremely low levels in order to protect bodies of water and to meet the requirements of the National Pollution Discharge Elimination System. However, there are non-point sources of pollution that improperly dispose of wastewater containing high levels of N and P into receiving waters, thus leading to eutrophication. For such sources, on-site treatment of wastewater is essential to reducing the impact of pollution.

What has the project done so far?

At the VSU Agricultural Research Station (ARS), researchers are studying the use of chemical precipitation methods to simultaneously remove nitrogen and phosphorus from municipal and animal wastewaters. One method uses a magnesium solution to precipitate out N and P in the form of dittmarite, a naturally occurring mineral that contains magnesium, phosphorus and nitrogen at specific molar ratios. Dittmarite may, in turn, be useful as a slow-release fertilizer for carrying these three macronutrients to plants. For farmers in Virginia and elsewhere, this technology can be used for the removal of N and P from animal wastewater retention ponds, fish wastewater and septic systems. The Soil and Water Laboratory at the ARS has conducted several bench-scale trials using wastewater from Blue Ridge Aquaculture in Martinsville, South Central Wastewater Authority in Petersburg, and from the Chesterfield County Department of Utilities.



What research is needed?

The bench-scale study has shown that N and P can be effectively removed from wastewaters as dittmarite. While the efficiency in removing P has been successful beyond expectation, the removal of N has fallen short of researchers' expectations. Approximately 95 and 21 percent of dissolved P and N have been removed from both synthetic and actual wastewater samples, respectively. Future research will focus on increasing the efficiency of nitrogen removal and the collection of dittmarite in a dry form to facilitate its land application. An economic assessment on the performance of dittmarite as a fertilizer supplement will also prove critical so that consumers (farmers, gardeners and landscape operators) might benefit from the product. Once the efficiency of removal of P and N, along with the economic value of the process, have been realized, then extension activities may be implemented to educate the public.

Want to know more?

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This project was supported with funding from a USDA-NIFA Capacity Building Grant, 2014-2017.

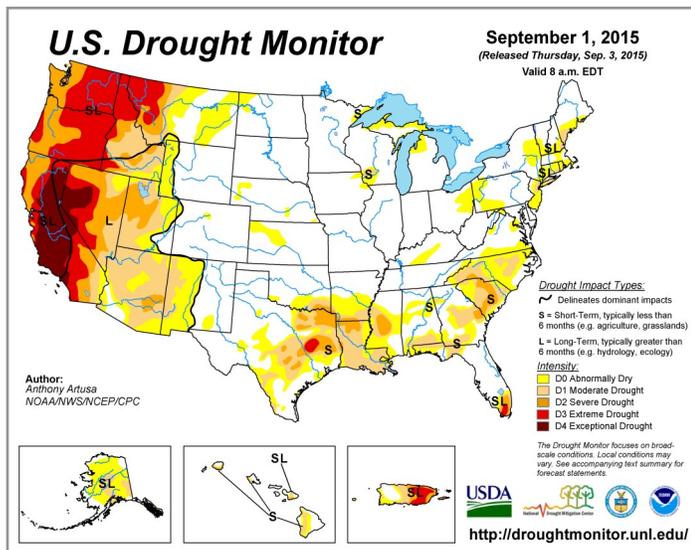
Impacts

- **The process removed over 95 percent of the phosphorus and 21 percent of the nitrogen from all three wastewaters. More phosphorus may have also been precipitated as other forms of phosphate-bearing minerals in addition to dittmarite.**
- **A pilot-scale wastewater treatment plant is currently being constructed at VSU.**

Tepary Bean: A Food Legume for Sustainable Production under Drought Conditions

Who cares and why?

Moisture deficits loom as one of the greatest challenges to future crop production in the U.S. The need for crop diversification, together with the development of crop varieties tolerant of drought, rank as important factors for achieving the production of adequate and nutritious food for a growing human population world-wide. Tepary bean (*Phaseolus acutifolius* A. Gray) is a truly American crop that is native to the southwestern U.S. and to northwestern Mexico. It was grown widely by Native Americans because of its perceived tolerance to drought.



What has the project done so far?

Research on tepary bean started at VSU in 1997 under the New Crops Program. Approximately 300 tepary bean lines have been characterized for their yield and nutritional qualities, and research has demonstrated that tepary bean is definitely a drought-tolerant crop. The seeds of three high-yielding and drought-tolerant breeding lines are being multiplied: VSU-Tepary-9-1 (black seed coat

color), VSU-Tepary-9-2 (tan seed coat color) and VSU-Tepary-9-3 (white seed coat color). Of the three cultivars, VSU-Tepary-9-3 has shown the highest drought tolerance, while VSU-Tepary-9-2 was intermediate in terms of tolerance, and VSU-Tepary-9-1 was the most sensitive to drought.

What research is needed?

Further research needs to be done to characterize the tepary bean germplasm and the nutritional quality traits as they relate to their drought tolerance.

Want to know more?

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This research was funded by USDA-NIFA through the 1890 Institutions Capacity Building Grants Program (2011-2015).

Impact

Three tepary bean lines have been identified for their high levels of yield and drought tolerance. These (VSU-Tepary-9-1, VSU-Tepary-9-2, VSU Tepary-9-3) are currently being multiplied.

Interaction of Diet, Molecular Genetics and Immune Health in the Production of Omega-chevon

Who cares and why?

Demand for goat meat exceeds supply worldwide. Most of the goat meat consumed in the U.S. is imported, and Virginia farmers contribute 3% to the total U.S. market. Amidst growing concerns over rising rates of obesity and cardiovascular disease, the meat industry has been forced to consider fat content in meat products, which has increased as a result of genetic selection for rapid growth and feed conversion. One way to address these concerns may be by increasing the amount of omega-3 and -6 fatty acids



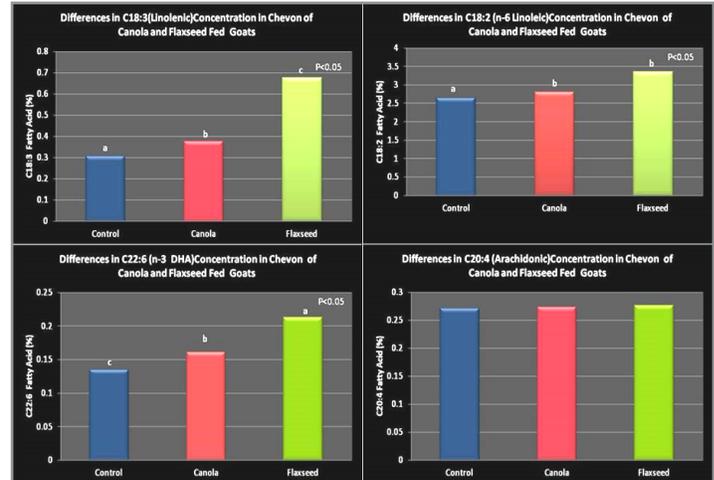
(FA) in goat meat. Also known as chevon, goat meat is generally lower in cholesterol and fat than beef, and increasing the levels of its omega-3 and -6 fatty acids may result in a meat that is truly heart-healthy. Developing an industry around

the production of such a heart-healthy meat may help to improve the economics of meat goat production in Virginia.

What has the project done so far?

This project aims to aid in the development of an industry that will produce enhanced omega-chevon for human consumption, thus expanding economic opportunities for meat goat producers in Virginia. Using canola seed and flaxseed, both of which are high in omega-3 and -6 fatty acids, scientists at VSU supplemented the feed of two breeds of meat goats, Spanish and Myotonic, in an attempt to increase the levels of omega fatty acids in the final meat products. Data from initial studies indicate that there are no adverse issues related to palatability, average daily weight gain or general health in meat goats that consumed feed supplemented with canola and flaxseed. Chevron from these goats showed a significant ($P < 0.05$) increase in omega-3, -6, and -9 fatty acids, compared to meat from those fed the control diet. However, chevon from goats fed diets supplemented with only flaxseed had

a marked increase ($P < 0.05$) in omega-3, -6, and -9 FA, compared to those fed the control diet or the diet supplemented with only canola. Canola and flaxseed diets reduced omega-7 FA in chevon compared to the control. Chevron from Spanish and Myotonic goats fed flaxseed showed increased ($P < 0.05$) levels of omega-3



and -6 FA compared to the control. However, C18:1 (omega-9) FA was higher in chevon from Myotonic goats than in Spanish goats, whereas meat from both Spanish and Myotonic goats had higher ($P < 0.05$) levels of C20:1 (omega-9) FA compared to meat from those fed the control diet.

What research is needed?

Further research is needed to examine the genomic, proteomic and metabolomic expression of genes that regulate immunity, fatty acid profile and cholesterol biosynthesis. Additionally, meat goat producers would benefit from research examining the effects that feed supplemented with flaxseed and canola seed might have on goats' immune response to natural gastrointestinal nematode infection, as they seek alternatives to chemical anthelmintics.

This project was supported by the USDA-NIFA Evans-Allen Program.

Want to know more?

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Impact

Supplementing goat feed with flaxseed and/or canola seed led to significantly higher levels of omega-3 and -6 fatty acids in goat meat.

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

Who cares and why?

Virginia agribusinesses continue to encounter the challenges that farmers across the South have experienced since the end of the federal tobacco price support program, including loss of income and loss of cropland. Edamame and specialty soybeans are both regarded as profitable substitutes for tobacco, or each can be grown as an add-on crop using methods similar to those used to grow general-purpose soybean. They have higher market values if harvested as fresh beans for vegetable diets or as mature beans to be used for soy-based products, especially those that are grown organically. As more people have become aware of the nutritional and health benefits of soy foods the demand for edamame and food-grade soybeans has increased significantly, leading to a promising opportunity for increasing farmers' incomes. In addition, growing vegetable and specialty soybeans also helps add to the diversification of both rural and urban agriculture, as well as of the food supply. Researchers in the ARS edamame/specialty crops breeding program are dedicated to developing new varieties of edamame and/or food-grade specialty soybeans that are suited to production in Virginia and the U.S. in general.

What has the project done so far?

VSU has established a vegetable soybean (edamame) research program and released three varieties, 'Asmara', 'Owens', and 'Randolph'. To facilitate the application or use of these varieties, scientists at VSU have investigated agronomic practices to expand the window for harvesting fresh beans. Hundreds of breeding lines are also being evaluated for their agronomic performance, yield potential and nutrient contents.

What research is needed?

To meet the requirements of superior varieties, continuing research will focus on: (1) evaluating and selecting breeding lines for the characteristics of yield and quality; (2) purifying and increasing superior lines/varieties for release; and (3) developing breeding

populations integrated with high yield potential and high quality traits for edamame and specialty/food-type uses. There is also a need to address the post-harvest processing, storage and marketing of edamame and specialty soybeans.



Want to know more?

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

Impacts

- **Edamame has been recognized as a value-added specialty crop and a potentially profitable option for small farmers in Virginia.**
- **Edamame has been successfully grown on small farms in Virginia.**
- **Research has been enhanced to include other food-grade types of specialty soybeans.**

Sorghum Production: A Promising Enterprise for Limited-Resource Producers in Virginia

Who cares and why?

Increasing global temperatures and more regular incidence of below-average rainfall have led to soil moisture conditions that are frequently sub-optimal for crop performance. To maintain current levels of productivity under these unfavorable conditions, crop farmers will need to choose varieties that are tolerant to moisture stress. Sorghum (*Sorghum bicolor* (L.)) is a hardy cereal crop capable of producing good yields in environments where other crops, such as corn or wheat, underperform. The sorghum plant is



Sweet sorghum stems and extracted juice

capable of increasing its water-use efficiency under drought conditions while also requiring less fertilizer than corn. Based on U.S. Grain Council statistics, grain sorghum is the country's third most important cereal crop, and the U.S. is its largest producer worldwide. The U.S. exports large quantities of sorghum to foreign markets, but demand for the crop is growing in local markets, too, as it becomes more widely used for a variety of purposes: grain sorghum is frequently used as a feed substitute for corn in feedlots; the stems of sweet sorghum are rich in fermentable sugars, which makes them appealing to the expanding U.S. bio-energy industry for use in the production of bio-ethanol; both grain and sweet sorghums have applications in the production of alcoholic beverages—grain sorghum is gaining popularity in the brewing industry as a new ingredient in the manufacture of beer, and the extracted juice from sweet sorghum stems is used to make rum and other sorghum spirits. Additionally, bagasse, the material left over after the juice is extracted, may provide alternative forage for

ruminants. The availability of this huge potential market provides producers with strong incentives to consider adopting sorghum production as a means of reducing the risks associated with increasingly unpredictable rainfall patterns.

What has the project done so far?

Over the last several years, researchers at VSU have carried out field trials on varieties of sweet sorghum and grain sorghum to identify plants that are suitable for production in the region around Chesterfield, Virginia. Numerous sweet sorghum varieties have been evaluated, including Della, Sugar Drip, Keller, Dale, Topper 76-6, Theis, M81-E and CHR-SW8. Fresh stem yield varied by variety, with some producing up to 80 tons per hectare. Some varieties yielded up to 15,000 L of extracted juice per hectare, the sucrose contents of which measured between 30 and 50 g per liter of solution. The starch content in the grain of some of the sweet sorghum varieties ranged from 270-560 g per kg, and the proportion of resistant and non-resistant starches differed widely among the grains of different varieties. Researchers from across Virginia have evaluated up to 40 varieties of grain sorghum as part of a state-wide variety trial, finding that grain yield varied widely among varieties. Those varieties with promising high yields have been identified and will be studied further to evaluate yield responses to fertilizer applications.

What research is needed?

The next phase of the research is to identify local processing facilities, including breweries, to determine the suitability of the varieties in question for use in the manufacture of their products. The results from these industrial studies will form the basis for extension activities to promote sorghum within the appropriate local markets. In the wake of federal policy that has affected the profitability of tobacco, farmers in Southside Virginia are in need of multi-purpose, low-input crops, and sorghum is a good fit.

Want to know more?

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This project is supported by Evans-Allen funds.

Impact

Several sweet sorghum varieties show promise for production in Southside Virginia, yielding up to 80 tons of fresh stems and 15,000 L of extracted juice per hectare, with the starch content in their grain ranging from 270-560 g/kg.

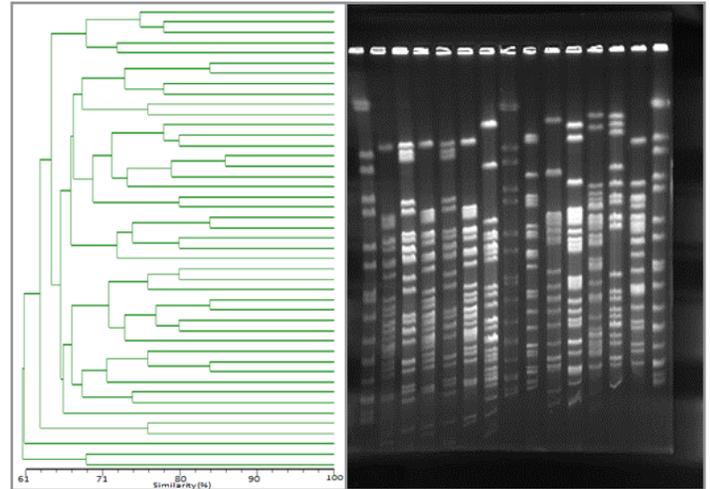
Food Safety Bout: Internet vs. Local

Who cares and why?

Pathogens affecting humans present a persistent challenge to the food industry. Improper handling at any of the stages between farm and table—harvest, processing, packaging, distribution—can result in the spread of undesirable microorganisms and lead to serious cross-contamination, product damage and/or foodborne illness outbreaks. According to the Centers for Disease Control and Prevention (CDC), more than 50 million (about one in six) Americans get a foodborne illness each year, costing the U.S. economy more than \$77.7 billion. Food items can be marketed directly to consumers by producers or distributors within or across countries through the Internet. This business approach satisfies consumers' desire to obtain products that they perceive to be of high quality directly from farms or production facilities by mail delivery. By paying higher prices, some consumers may believe that they are getting products of superior quality. In addition, the rise in U.S. demand for small ruminant meat has been attributed to the influx of ethnic groups from areas of the world where those foods comprise a significant portion of the diet, as well as to the increase in the consumption of ethnic foods as consumers explore and broaden their culinary experiences. There is no scientific evidence, however, showing that Internet-procured food products are of a higher microbial quality than those that are purchased locally.

What has the project done so far?

Researchers at VSU evaluated the microbial quality of small ruminant meat sold either through local (Virginia) or Internet (U.S.) retail markets. Results showed that the levels of aerobic mesophiles, psychrotrophs and coliforms found in locally acquired products were significantly higher than those found in products purchased online. However, *E. coli* was found at similar levels in meat samples regardless of market source. *Listeria* spp. were present in the range of 23 to 40% in meat from local vendors and in 17 to 80% of meat samples from Internet markets. None of the microbes found in any of the different brands or market sources



had matching PFGE profiles, confirming that none of them came from a common source. Furthermore, the average Internet meat price was about 1.2 to 2.7 times higher than that offered by local vendors. This project identified differences in the microbial quality of meat products based on market source. Due to the presence of excessive microbial counts and the high occurrence of pathogens, researchers recommend careful handling of all food products, regardless of where they were purchased.

What research is needed?

Due to the limited availability of sample numbers tested during this project, continued research efforts using larger sampling numbers are needed to determine the cause(s) of the observed results in microbial prevalence and levels in order to support the healthy development of the emerging Internet market.

Want to know more?

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This project was supported through Evans-Allen funds, 2013-2015.

Impacts

- **Locally purchased lamb/goat meat showed higher rates of mesophiles, psychrotrophs and coliforms than that bought over the Internet.**
- **None of the microbes found in any of the samples appears to come from a common source.**
- **The price of Internet meat was 1.2 to 1.7 times higher than the price of local meat.**

Suppression of SpKRP1 Alters Leaf Shapes, Delays Flowering and Increases Biomass in *S. Pennellii*

Who cares and why?

Solanum pennellii is a wild relative of the cultivated tomato (*S. lycopersicum*) that is native to arid regions of Peru. One important factor facilitating the plant's survival in arid conditions is the secretion of 2,3,4-tri-O-acylated glucose esters (glucolipids) that coat every one of its leaves in its entirety. About 25% of the plant's energy is used to synthesize these unique esters. Like their counterparts that are produced in oil crops, these glucolipids have the potential to be used in industry and transportation as biofuels. The leaf biomass of *S. pennellii*, however, is relatively small compared to that of cultivated tomatoes. Increasing its leaf biomass would, therefore, lead to more production of glucolipids that are available to make bio-gasolines.

What has the project done so far?

Previous reports have shown that the inhibition of KRP1, a cyclin-dependent kinase inhibitor, could increase leaf biomass in tomato and Arabidopsis by roughly 10 to 20%. VSU scientists conducted research cloning and manipulating the KRP1 gene in *S. pennellii*. We successfully cloned the homolog of the tomato KRP1 (LeKRP1) gene from *S. pennellii* (designated as SpKRP1). The SpKRP1 gene was inhibited using RNA interference (RNAi) technology in *S. pennellii* through an *Agrobacterium*-mediated transformation system. The transgenic lines carrying the RNAi construct displayed altered leaf shapes and significantly delayed

flowering time. Furthermore, analysis of leaf biomass indicated that transgenic lines drastically increased leaf biomass production by about 28%. This research demonstrated that manipulation of the KRP1 gene in *S. pennellii* can increase biomass production, which will lead to an increase in production of glucolipids to be used to make bio-gasoline for uses in industry and transportation. Furthermore, our research may also provide a new strategy for improving biomass production in other crop species.

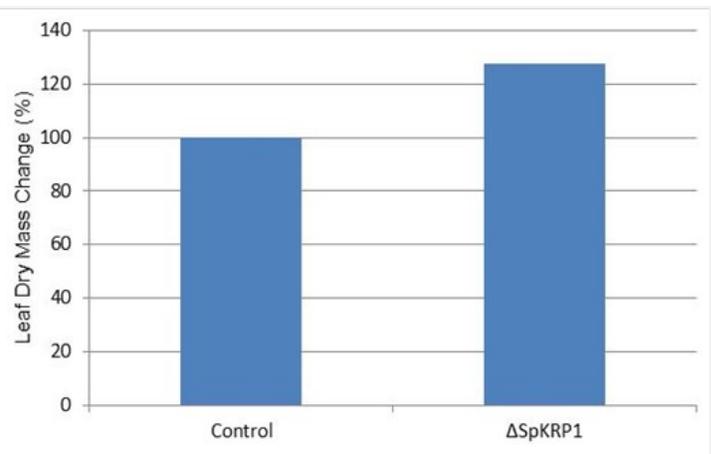
What research is needed?

Findings from this project are applicable to other crop species. For example, manipulation of the homologous gene of SpKRP1 in other bioenergy crops will increase biomass production leading to higher levels of oil that are available for bioethanol production. Furthermore, bioengineering the SpKRP1 homologs in leafy vegetables may potentially extend growing seasons and increase the yields of leafy vegetables, thus directly benefiting farmers who produce leafy vegetables for their income.

Want to know more?

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This project was supported with funds by USDA-NIFA through an 1890 Institution Teaching, Research and Extension Capacity Building Grant.



Impact

Inhibition of the SpKRP1 gene resulted in an increase in leaf biomass of about 28%, which will lead to an increase in production of glucolipids that can be used as biofuel.

Is Hops a Viable Alternative Crop for Virginia?

Who cares and why?

There is increasing interest in hops as a potential alternative crop in Virginia in response to the rapid growth of the craft beer sector both within the Commonwealth and across the nation. In 2012, the Virginia legislature passed SB604, also known as the tasting room bill, which allows breweries to sell their products for on-site consumption; since then, the number of craft breweries in the state has doubled, leading to new opportunities for Virginia farmers to supply ingredients such as hops. A few Virginia growers with 0.25 to 0.5 acres of hops (mostly of the Cascade variety) are currently selling wet hops to local breweries at \$15 per pound, and there is potential to expand both acreage and product diversity through research and outreach.



VSU's newly-established hop yard

What has the project done so far?

With support from the Virginia Department of Agriculture and Consumer Services (VDACS), VSU has constructed a 1-acre hop yard that will be used for research and demonstration. Thirty-five varieties have been planted in the yard as part of field trials to test performance under Virginia conditions. VSU's Alternative Crops program has entered into collaborative arrangements with North Carolina State University and Virginia Tech to share ideas and to leverage the available resources for establishing research and extension support for growing hops in the region.

What research is needed?

The primary hops producing region in the U.S. is the Pacific Northwest, which has a climate that is milder and drier than that of the mid-Atlantic. This means that managing pests, diseases and other stressors will be a big challenge for farmers in Virginia and

the region. Research needs to be conducted to identify hops cultivars that are or can be adapted to this region, to cultivate sustainable approaches for pest and disease control and to develop recommendations for key agronomic practices. In the medium term, the need will arise for postharvest handling and processing solutions that are optimized for Virginia conditions. The Alternative Crops program is currently pursuing funding and collaborations that will address all of these issues over the next 3 to 5 years.

Want to know more?

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This project has been supported by a grant from VDACS for hop yard construction. Support has been secured from USDA-NIFA through the 1890 Institution Capacity Building Program, Evans-Allen formula funds and the Specialty Crop Research block grant program for research and outreach.

Impacts

- **The research and demonstration hop yard has been completed, providing a site to conduct research projects and demonstrations that will assist hops producers.**
- **Researchers have planted 35 hops varieties for a series of field trials.**
- **VSU has established links with other research and extension programs in the region, thus creating a network for sharing and disseminating information and for leveraging resources in support of the hops industry.**

Unique Capabilities of Native Warm-Season Grasses

Who cares and why?

Forage native warm-season grasses (NWSGs) continue to garner growing attention from American farmers as consumers show more interest in issues concerning water quality in farming systems and in purchasing meat products from animals raised on grass. In the U.S., many advocates of sustainable environmental protection in managed ecosystems are working to promote the ecological importance of using NWSGs in agricultural landscapes. It is now widely accepted that most NWSGs of North America play unique ecological roles owing to their structural morphology, their growth habits and their ability to adapt to hot and droughty growing conditions. These NWSGs combine well with non-grass forage species in pastures and are considered dependable sources of summer forage for livestock, and their potential should be optimized. Most NWSGs have the added benefit of making good habitat for grassland birds and small mammals, as well as the potential to be used for sustainable bio-energy production. Because of their tall growth habit, NWSGs provide little or no incentive for small ruminants to graze too close to the ground where the animals might pick up larvae of intestinal parasites. Additionally, small ruminants grazing NWSGs that are inter-grown with bio-active forages such as chicory or lespedeza have even been found to be less impacted by gastro-intestinal nematode



infections. NWSG stands that are appropriately managed may help to improve the sustainable production of summer forage in Virginia and across the mid-Atlantic region, and growing them in pastures with bio-active forages may be a

useful strategy for reducing the dependency that small ruminant producers currently have on chemical anthelmintics.

What has the project done so far?

Researchers at VSU are conducting on-going studies using four NWSGs grown in either pure or mixed stands to investigate the effects of season-long intensive forage harvesting on subsequent stand performance. Recovery and subsequent growth of two-year-old seeded and transplanted stands harvested once, twice or three



times a year are being compared on the basis of height, ground cover and leafiness. Special attention is paid to their forage production attributes and to the sward structural features that are usually relevant to wildlife habitat, especially for ground-nesting birds and small mammals.

What research is needed?

Follow-up studies will evaluate the performance of forage chicory and lespedeza inter-grown with eastern gamagrass as they are rotationally grazed by growing goats.



Producers learn about the anthelmintic potential of forage chicory

Want to know more?

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This research is funded by the Evans-Allen Program.

Impact

Expected findings will benefit small producers attempting forage-based sheep and goat production in Virginia and the larger mid-Atlantic region.

Producing Crossbred Lambs from Landrace Hair Sheep Ewes Using Dorset Rams



Who cares and why?

Hair sheep are widely considered an alternative to traditional wool breeds as farmers aim to address changes that will increase the viability of sheep production. Hair sheep have a hair coat as opposed to a wool fleece, along with other adaptive characteristics that allow them to be productive under hot and humid conditions with marginal quality forages and under exposure to gastrointestinal parasites. They are easy to care for with no need for shearing, leading to reduced labor and feed costs and making their management more efficient. However, slower growth rates and smaller, leaner carcasses may make them less appealing to some markets. Barbados Blackbelly and St. Croix landrace hair sheep breeds have both shown documented high levels of prolificacy under extended seasonal breeding, as well as parasite tolerance. Using these ewes as maternal breeds in a terminal sire breeding scheme may increase the efficiency of sheep production in the mid-Atlantic region. Such a lamb production system requires limited inputs to maintain the ewes, while generating crossbred lambs with improved muscling and increased growth rates. Lambs produced in this system may be marketed under specialty or value-added labels such as organic and/or grass-fed.

What has the project done so far?

The experiment evaluated the effect of crossbreeding Dorset rams with Barbados Blackbelly and St. Croix ewes on the reproductive performance of ewes and the growth performance of lambs under fall mating. Mature Barbados Blackbelly and St. Croix ewes were bred either to rams of like breed or to Dorset rams in November, initially by artificial insemination, followed by a 30-day natural mating period. Twelve sires (3 Dorset, 4 St. Croix, and 5 Blackbelly) were used for the two types of mating. Ewes were managed on pasture as a single group, except during mating, then supplemented with concentrate

feed during late gestation and lactation. Ewes lambed on pasture; lambs were weaned at 2 months of age. There were no differences between purebred and crossbred matings in overall pregnancy rate (>95%), still born lambs (9%), pre-weaning lamb loss (13%), or in litter size at birth (1.97 lambs) or at weaning (1.57 lambs). Crossbred litters were, however, 1 kg heavier at birth and 4 kg heavier at weaning than purebred litters.

After weaning, thirty-six purebred and crossbred lambs were placed on stockpiled fescue pasture and were either grazed pasture-only or supplemented with corn or soy hull for 2.5 months. At the end of grazing, at approximately 9 months of age, crossbred lambs were 4.5 kg heavier than their purebred counterparts. Fecal parasite egg counts were similar between purebred and crossbred lambs; based on their anemia scores, however, three crossbred lambs needed deworming, while no purebred lambs needed treatment. Results show that terminal sire mating of landrace hair sheep increased pre- and post-weaning growth performance of lambs without adversely affecting survival to weaning, but the crossbred lambs may show some loss of parasite resilience after weaning.



What research is needed?

More research is needed on the effects of terminal sire mating of landrace hair sheep on carcass quality and composition. Lamb meat products from these rearing systems need to be test-marketed in direct-marketing channels in order to gauge consumer acceptance.

Want to know more?

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This research was supported by the USDA-NIFA 1890 Institution Capacity Building Program.

Impacts

- **Crossbreeding landrace hair sheep breeds with Dorset wool rams under fall mating had no effect on pregnancy rate, litter size or lamb survival, but litter weights at birth and weaning were significantly improved.**
- **Crossbred lambs had faster growth rates when supplemented on pasture, but may be slightly more susceptible to gastrointestinal parasites than purebred hair lambs.**

Pomace from Virginia-grown Grape Varieties as a Potential Source of Antioxidant and Antibacterial Compounds for Value-Added Application

Who cares and why?

Grape pomace is made of all the solid remains that come out of pressing grapes for juice or wine—the skin, pulp, seeds and stems. Large quantities of grape pomace come from the juice and wine industries each year; over 16 million tons of grape by-products were reportedly produced in 2010. For the most part, grape pomace is currently used for animal feed and organic fertilizers. But, because it contains high levels of polyphenols, it also holds a lot of potential as a natural source of antimicrobials, antioxidants and dietary fiber that can be used in food products, pharmaceuticals or cosmetics. The beneficial properties of pomace may, however, vary by grape variety, and they may be affected by factors such as agronomic practices and environmental conditions. Currently, there is no information available on the pomaces from varieties of grapes that are grown in Virginia.

What has the project done so far?

Researchers have performed studies directed at 1) quantifying the composition and concentrations of polyphenolic compounds in pomaces from four Virginia-grown grape varieties [Cabernet Franc and Chambourcin (red); Viognier and Vidal Blanc (white)], and 2) assessing the antioxidant and antibacterial activities of



Grape pomace and its extract

each variety to determine its value as a prospective source of natural antioxidants and antimicrobials. Pomaces from white grapes had a higher solvent extraction yield than those from red varieties. Cabernet Franc had the highest polyphenolic content (total phenolics, total flavonoids, tannins, condensed tannins) and antioxidant capacities. Each extract exhibited antibacterial activity against *Listeria monocytogenes* ATCC 7644 and *Staphylococcus aureus* ATCC 29213, but not against *Escherichia coli* O157:H7 ATCC 3510 or *Salmonella typhimurium* ATCC 14028.

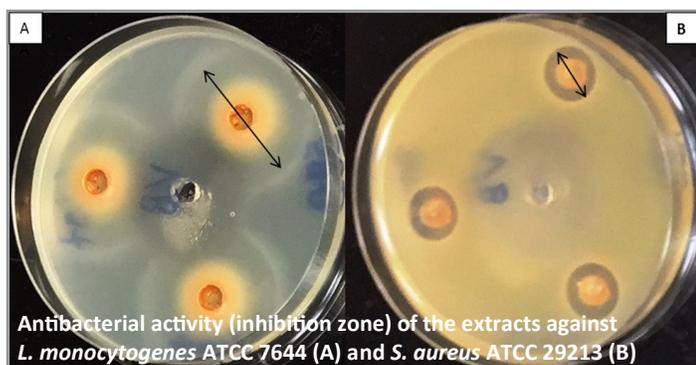
What research is needed?

More research is needed around the effectiveness and potential use of grape pomace extract as an antioxidant and antimicrobial agent to be used in deli meat packaging and as a new ingredient to aid in salt reduction in processed meats.

Want to know more?

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This research is supported through funding from the USDA-NIFA 1890 Institution Capacity Building Grant Program.



Antibacterial activity (inhibition zone) of the extracts against *L. monocytogenes* ATCC 7644 (A) and *S. aureus* ATCC 29213 (B)

Impacts

- Utilization of grape pomace provides benefits to the wine industry and to local grape producers by adding value to the by-products and by reducing disposal costs and the volume of the waste stream, both of which may lead to increased profits for grape and wine producers.
- Grape pomace shows promise as a natural compound to be used in a variety of products, which may appeal to consumers concerned about the risks associated with synthetic compounds.

Meat Goat Nutrition

Who cares and why?

Goat production in the U.S. is characterized as an emerging, non-traditional agricultural enterprise. In the past decade, the production of meat goats has increased by about one-third in response to the increase in demand for goat meat, particularly from specialty markets which are growing as a result of continued changes in U.S. demographics. Additionally, meat goats are



appealing to producers because they are economical to grow. Nutrition plays an essential role in any livestock operation, and feed costs account for a major portion of the costs associated with meat goat production. Meeting future forage demands for small ruminant production at a lower cost will be challenging, and identifying alternative feed sources will benefit producers. One possible alternative is crop residue, the non-edible plant parts that are left in the field after crops have been harvested and thrashed. Despite low levels of digestibility, metabolizable energy, mineral element contents and forage quality, crop residues can be used to meet the maintenance requirements of ruminants by using alkali or oxidizing chemicals to improve digestibility and nutritional quality. This may be particularly helpful during feed shortages by providing producers a relatively low-cost option for maintaining their herds.

What has the project done so far?

A study was undertaken to determine the effects of ammonium hydroxide (NH_4OH) treatment on the composition and *in vitro* dry matter disappearance (IVDMD) of the residue of two vegetable soybean varieties (Asmara and Randolph). Soybean residue was

treated with no water and no NH_4OH , water only, and NH_4OH at 50 and 100 g per kg of residue dry matter and allowed to react for one week before chemical analysis was performed. The crude protein increased ($P < 0.05$) and the IVDMD improved ($P < 0.05$) with alkali treatment. The fiber content (ADF and NDF) was also reduced ($P < 0.05$) by the alkali treatment, but there was no difference ($P > 0.05$) in the effects of the alkali treatment levels. Ammonium hydroxide treatment increased the IVDMD ($P < 0.01$), but no difference ($P > 0.01$) was observed between the alkali treatment levels.

What research is needed?

The development of more economical and safe procedures for handling crop residue to improve digestibility of the structural cell wall components would be very beneficial for facilitating the use of soybean residue as a potential source of feedstock for feeding ruminant livestock, as well as for biofuel production.



Want to know more?

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This project was supported by Evans-Allen funds.

Impact

Identified a means of increasing digestibility of soybean residue, which may lead to its use as a supplemental feed source for small ruminants.

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Randolph Farm

Photograph by William Porter

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