DEVELOPING AN ALFALFA HAY EXPORT MARKET IN THE HUMID EASTERN UNITED STATES

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Project Director: TEUTSCH, C. D.

Recipient Organization: VIRGINIA POLYTECHNIC INSTITUTE, BLACKSBURG, VA 24061

Performing Department: Southern Piedmont AREC

Research Effort Categories: Basic 0%, Applied 100%, Developmental 0%

Knowledge Area: 102 - Soil, Plant, Water, Nutrient Relationships

Subject of Investigation: 1640 - Alfalfa

Field of Science: 1060 - Biology (whole systems)

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Non-Technical Summary

Alfalfa possesses the ability to produce high yields of nutrient dense forage, has excellent drought tolerance, and is an aggressive N fixer. Even so, alfalfa production has declined in the Mid-Atlantic Region from 1 million acres in the mid-1990s to 0.5 million acres in 2013. In the
past, alfalfa grown in the United States has been used predominately for livestock feeding. However, a strong export market has developed in the western United States. In the humid eastern United States, alfalfa grown for export is currently non-existent. However, a private commodity trading company has expressed interested in developing an alfalfa export market centered in the Mid-Atlantic Region. If this project is fully implemented, alfalfa acreage in the Mid-Atlantic region could expand by more than 250,000 acres. The development of a successful alfalfa export market in the humid eastern United States is highly dependent upon the production of large quantities of uniform, properly cured, high quality alfalfa hay and containerizing that hay for shipping abroad. This project is designed to evaluate the impact of using hay preservatives (propionic acid and anhydrous ammonia) on the quality and stability of containerized alfalfa hay and to develop and implement an alfalfa production school and informational website that specifically targets and supports alfalfa producers in the Mid-Atlantic Region. Animal Health Component 0%

Goals / Objectives

The overarching objective of this project is to aid in the development of an alfalfa export market in the humid eastern United States. This will be accomplished through these specific objectives: To evaluate the impact of propionic acid application at baling and container loading and ammonization of loaded containers on quality and stability of containerized alfalfa hay. To develop an alfalfa production school that specifically targets hay producers and agricultural professionals who are located in the Mid-Atlantic Region. To develop regional website dedicated to the production, utilization, and marketing of high quality alfalfa hay and baleage in the Mid-Atlantic Region.

Project Methods

The experimental design is a random complete block with three replications. Treatments include 1) double compressed small square bales, 2) double compressed small square bales treated with a propionic based preservative at baling, 3) double compressed small square bales treated with propionic acid based preservative at baling and ammonization of the container after loading, and 4) double compressed small square bales treated with propionic acid based preservative at baling and at just prior to loading into containers. Alfalfa hay will be secured from a local hay producer, three-fourths of the hay will be treated with CropSaver (Harvest Tec, Hudson, WI), a buffered propionic acid based hay preservative at baling at a rate of 5 lb/ton. The preservative will be applied directly to the windrow by spraying just prior to baling. Hay will be baled at 18% moisture and after baling will be stored in an open sided building for 5 weeks prior to being compressed and loaded into mini shipping containers. A modified tobacco press will be used to double compress the small square bales to a uniform density of approximately 20 lb/ft2 (Fig. 4). Bales will then be loaded into containers. Just prior to loading, bales in treatment 4 will have a surface application of CropSaver hay preservative sprayed on at a rate of 0.0075 lb/bale. Once all containers have been loaded, treatment 3 will be ammoniated using anhydrous ammonia at a rate of 3 lb/ton DM (Personal Communication, Bill Weiss, 2014).
Containers will be closed and not reopened for 45 days. This period of time is the approximately transit time from Virginia to the end user in China. The relative humidity and temperature inside of each container will be monitored with data loggers (HOBO U23 Pro v2 External Temperature/Relative Humidity Data Logger, Onset Computer Corporation, Bourne, MA) every 5 minutes. An external weather station will be used to monitor external weather conditions. Hay will be cored just after baling, just prior to double compression, and immediately after reopening the containers. Just after baling, 3 random samples, each consisting of 6 cored bales from the non-treated hay and 9 random samples, each consisting of 6 cored bales from the hay treated with CropSaver will be taken. Just prior to double compression, 6 random bales from each treatment-replication combination will be cored and the six cores composited. Immediately after reopening the containers, 6 random bales from each treatment-replication combination will be cored and the six cores composited. Hay flakes from each treatment-replication combination will be analyzed for color at baling, just prior to double compression, and immediately after reopening of the containers (Kendal et al., 2013). Prior to drying each sample will be subsampled and the subsample will be analyzed for mold/yeast at Cumberland Valley Analytical Services, Hagerstown, MD. These subsamples will NOT be dried and ground. All remaining samples will then be weighed, dried for 3 d at 60 C in a forced air oven, and then reweighed. Samples will then be ground to pass through a 1 and 2 mm screen using Wiley (Thomas Scientific, Swedesboro, NJ) and Cyclone (Udy Corporation, Fort Collins, CO) sample mills, respectively. Samples will be analyzed for neutral detergent fiber (NDF), acid detergent fiber (ADF) and crude protein (CP) using near infrared spectroscopy. WINISI II software was used to select a calibration data set for wet chemistry determination (Infrasoft International, Port Matilda, PA). Neutral and acid detergent fibers will be determined using the ANKOM filter bag system (ANKOM Technology, 2013a; ANKOM Technology, 2013b). Total N will be determined using a modified Dumas method (Elementar Americas, Mt Laurel, NJ). Crude protein will be calculated as total N x 6.25. Data will be analyzed using the General Linear Model procedure from SAS (Cary, NC). Summarized results will be published in a refereed journal and posted on the Mid-Atlantic Alfalfa Information X-Change. The graduate student working on this project will present this data to hay growers and agricultural professionals at the American Forage and Grassland Council 2017 Annual Conference. The development of a successful alfalfa export market in the humid eastern United States is highly dependent upon the production of large quantities of uniform, properly cured, high quality alfalfa hay. This would be virtually impossible to accomplish without a strong educational component that focuses the efforts of alfalfa growers in the Mid-Atlantic Region on the production of a premium hay product. These schools would be a collaborative effort of researchers and extension workers in Virginia, Pennsylvania, and Delaware and would be carried out in year 2 of this project. The schools would be held in Virginia, Pennsylvania, and Maryland-Delaware. The curriculum would include all portions of alfalfa production starting at variety selection and ending at marketing. A notebook that includes a copy each speaker’s presentation, along with supporting publications will be assembled and distributed at the schools. All presentations will be recorded using CAMTASIA software and the videos will be post
on the Mid-Atlantic Alfalfa Information X-Change. Speakers would be carefully selected, internationally renowned experts in alfalfa production and marketing. Funds from this grant would be used to support planning and organization efforts, speaker and organizer travel costs, and speaker fees. Participants would be required to pay a registration fee for the school to ensure student buy in. Industry support for this school will also be solicited. A participant survey will be conducted at the start and end of this school. A follow-up survey will be conducted in year 3 of this project to gauge implementation of practices and concepts learned in the school. Results of these surveys will be compiled and presented at the American Forage and Grassland Council's Annual Meeting in 2018. A regional website entitled "Mid-Atlantic Alfalfa Information X-Change" will be developed that warehouses and organizes information pertinent to alfalfa production in the Mid-Atlantic Region. The website will include links to alfalfa production publications, a calendar of events, videos from the Mid-Atlantic Alfalfa Production School, variety testing results from the Mid-Atlantic Region and beyond and contact information for local extension resources in each state. This website will be housed at Virginia Tech’s Southern Piedmont Agricultural Research and Extension Center (AREC). The design will allow for easy and intuitive navigation of the site and include a search tool. Upon exiting the site users will be prompted to take a very short survey (3 to 5 questions) about the usefulness and accessibility of the website. Website usage would be tracked and reported.

PROGRESS 09/01/14 TO 08/31/17

Outputs

Target Audience: The target audiences reached during this reporting period included agricultural producers (75) and agricultural professions working with producers (25). These groups were reached during an educational event that featured this project. A field tour of the research station that featured the project site was held in late July 2016. This event was attended by 100 persons. We also reached high-school aged students (30) during a tour of the research station that featured this project. Students learned about hay production, storage, and the potential for hay export from the humid eastern United States.

Changes/Problems: In January 2017, I started a new position at the University of Kentucky’s Research and Education Center located in Princeton, KY. My new responsibilities and distance from Virginia, made this objective difficult to complete. However, I have taken this objective and designed an alfalfa educational program focusing on intensive alfalfa management. This program will be conducted in February 2018 at the Alfalfa and Stored Forage Conference held in Cave City, Kentucky. Topics that will be covered include variety selection, fertility management, equipment selection and adjustment, weed and insect control, and marketing. The winter conference will be followed by a summer field day designed to reinforce concepts learned and allow producers and agricultural professional to see these
practices implemented in the field. The contributions of the USDA-NIFA will be acknowledged in both the promotional materials and the conference proceedings.

What opportunities for training and professional development has the project provided? This project was featured on the annual field days, in-service training programs, tours to Virginia Tech’s Southern Piedmont AREC, and results were presented at the American Forage and Grassland Council’s annual meetings. These programs discussed the potential development of a hay export markets in the humid eastern United States, along with the challenges facing producers attempting to make premium quality hay in a high rainfall environment. During the course of this project we provided tours and training for students, producers, and agricultural and conservation professionals. These groups included: Summer Field Day at Virginia Tech’s Southern Piedmont AREC. July, 2015. 85 participants. Initial results presented at the Annual Meeting of the American Forage and Grassland Council held in Baton Rouge, LA. January, 2016. This presentation reach agency and industry personnel, undergraduate and graduate students, research scientists and extension specialists, and agricultural producers. Students from Ferrum College. May, 2016. 10 students and instructors. Forage in-service training for certified nutrient management planners. June, 2016. 25 attendees. Forage in-service for extension agents held at Virginia Tech. June, 2016. 40 participants. Summer Field Day at Virginia Tech’s Southern Piedmont AREC. July, 2016. 80 participants. Project overview and tour for students from Virginia State University. August, 2016. 10 students and instructors. Project overview and tour for students from Virginia Tech. August, 2016. 15 students and instructors. Final results were presented at the Annual Meeting of the American Forage and Grassland Council held in Roanoke, VA. January, 2017. This presentation reach agency and industry personnel, undergraduate and graduate students, research scientists and extension specialists, and agricultural producers.

How have the results been disseminated to communities of interest? Results were disseminated by the following mechanisms: Tours of research area (3) In-service trainings (2) Field days (3) Professional meetings (2) Publication of thesis and abstracts (3)

What do you plan to do during the next reporting period to accomplish the goals? Project completed.

Impacts

What was accomplished under these goals?

Objective 1: To evaluate the impact of propionic acid application at baling and container loading and ammonization of loaded containers on quality and stability of containerized alfalfa hay. An experiment was conducted that evaluated the impact of 1) propionic acid at baling, 2) propionic acid at baling + surface applied propionic acid at container loading, 3) propionic acid at baling + ammonization of the container after loading, and 4) no preservatives on the nutritive value and
microbial growth of hay that was containerized to simulate shipping abroad. Propionic acid was applied at a rate of 2.5 kg Mg-1 of hay at baling to all treatments except the control. Hay was then stored for 5 weeks before compressing to a density of 320.0 kg m-3. Immediately before containerizing hay, treatment 2 received a surface application of propionic acid at a rate of 3.4 g bale-1. After loading hay into containers, treatment 3 was ammoniated at a rate of 1.5 kg NH3 Mg-1 DM. Temperature and relative humidity in the containers were monitored for the 45-day storage period. Hay was sampled at compression and immediately after opening the containers. There were no treatment effects on nutritive value parameters after containerization (P < 0.05). Neither propionic acid at harvest, nor treatments at containerization had an effect on mold development in this study (P < 0.05). We conclude that if hay is below 15% moisture at containerization, no chemical is needed.

Objective 2: To develop an alfalfa production school that specifically targets hay producers and agricultural professionals who are located in the Mid-Atlantic Region. Before objective 2 could be completed, I accepted a position at the University of Kentucky in the Department of Plant and Soil Sciences. My new responsibilities and distance from Virginia, made this objective difficult to complete. However, I have taken this objective and designed an alfalfa educational program focusing on intensive alfalfa management. This program will be conducted in February 2018 at the Alfalfa and Stored Forage Conference held in Cave City, Kentucky. Topics that will be covered include variety selection, fertility management, equipment selection and adjustment, weed and insect control, and marketing. The winter conference will be followed by a summer field day designed to reinforce concepts learned and allow producers and agricultural professional to see these practices implemented in the field. The contributions of the USDA-NIFA will be acknowledged in both the promotional materials and the conference proceedings.

Objective 3: To develop regional website dedicated to the production, utilization, and marketing of high quality alfalfa hay and baleage in the Mid-Atlantic Region. Before objective 3 could be completed, I accepted a position at the University of Kentucky in the Department of Plant and Soil Sciences. I have modified this objective slightly and developed the "Alfalfa Information X-Change" as part of the Forage Extension Website at the University of Kentucky. This "clearinghouse" for all things alfalfa includes sections on varietal selection, fertilization, establishment, harvesting and utilization, weed, insect, and disease management, economics and marketing, grazing, and stand assessment. This website is designed to be dynamic, allowing new information to added and old information to removed. The website will be updated quarterly. The following link will take you to the University of Kentucky’s Forage Extension Website and the "Alfalfa Information X-Change" can be accessed by clicking on alfalfa x-change icon[http://www.uky.edu/Ag/Forage/].
Publications

Type: Theses/Dissertations Status: Published Year Published: 2017 Citation: Quick, K.K. 2017. Impact of Microbial Inhibitors on the Nutritive Value of and Microbial Growth in Alfalfa Hay Containerized for Exported from the Humid Eastern U.S. Thesis. Virginia Tech, Blacksburg.
