Biomass Sorghum and Sweet Sorghum Data Gathering Report

Order Number: D15PX00044

Submitted to:
USDA-RMA
COTR: Jaime Padget
6501 Beacon Drive
Kansas City, Missouri 64133-6205
(816) 926-8466

Submitted by:
Watts and Associates, Inc.
4331 Hillcrest Road
Billings, Montana59101
(406) 252-7776
watts@wattsandassociates.com

Due Date: April 6, 2015

Table of Contents

List of Tables

List of Appendices

Executive Summary

This report addresses issues regarding crop insurance development opportunities and challenges for biomass and sweet sorghum grown as a feedstock for energy production and biobased products.[1] Section 1522(c)(17)(A) of the Federal Crop Insurance Act as amended by the 2014 Farm Bill (Public Law 113-79) authorizes the contract for the study under which this report was prepared. Section 1522(c)(17)(A) states: "The Corporation shall offer to enter into 1 [one] or more contracts with qualified entities to carry out development regarding − (i) a policy to insure biomass sorghum that is grown expressly for the purpose of producing a feedstock for renewable biofuel, renewable electricity, or biobased products; and (ii) a policy to insure sweet sorghum that is grown for a purpose described in clause (i)." This data gathering report is required by contract to provide information and analysis "to aid in the development of a crop insurance program [for biomass and sweet sorghum grown as an energy or biobased product feedstock] and identify issues related to potentially providing coverage."[2]

The Secretary of the United States Department of Agriculture (USDA) was authorized by the 2002 Farm Bill (the Farm Security and Rural Investment Act of 2002, Public Law 107-171) to identify products as biobased if they are a commercial or industrial product other than food or feed composed (in whole or in significant part) of biological products, renewable domestic agricultural materials, forestry materials, or an intermediate feedstock derived from these products or materials. Consequently, sorghum grown for food or feed is not addressed, except incidentally, as the subject of this study.

While the focus of the Contractor's research effort was gathering information about biomass sorghum and sweet sorghum and the feasibility of developing an insurance program, the contract specifies: "RMA [the USDA Risk Management Agency] is not looking for a complete feasibility study, but is looking for specific aspects needed to understand and determine what type of crop insurance program will work best for these crops, producers, and for the specific data needed to create a crop insurance program that covers producers with an optimal program."[3] Therefore, the analysis of feasibility was focused on approaches to develop an insurance product and the barriers those approaches introduce rather than on reasons such a development effort might be unfeasible. The contract further identifies areas of research that supported the preparation of the report. The findings related to these topics are summarized below in the order presented in the contract.

Listening Sessions: The Contractor shall analyze, summarize and interpret the data gathered.

The Contractor contacted producers, insurance providers, bioenergy representatives, and leaders representing producers at the state and national levels to determine the level of interest held by the industry in an insurance program for biomass and sweet sorghum produced as a feedstock for energy and biobased products. These efforts culminated in listening sessions in California, Florida, Kansas, and Louisiana. The sessions were poorly attended. Participants included two

[1] The government is inconsistent in its use of a hyphen in the term "biobased products." As the official definition excludes the hyphen, that is the convention that will be used in this report.
[2] United States Department of Interior (DOI), Order D15PX00044, page 23 of 35.
[3] Solicitation Number D14PS00630-A2, page 50 of 73.

producers, three producer organization representatives, three insurance industry representatives, and three biobased products industry representatives. The Contractor also communicated with an additional 43 stakeholders by email or in individual conversations in person or by telephone.

The strongest interest in crop insurance for biomass and sweet sorghum as a feedstock for renewable biofuel, renewable electricity, or biobased products came from the end users of the crop. These stakeholders believed having a dependable supply of sorghum as a feedstock was dependent on the availability of crop insurance for the producers of that feedstock sorghum. In contrast, many of the producers who communicated with the Contractor seemed to consider the sorghum as a catch crop. Based on testimony from stakeholders, the limited demand for biomass and sweet sorghum, and especially for these crops as a feedstock for energy and biobased products, was influenced by a decrease in federal support for production of biofuels and a drastic decline in the price of petroleum.

Description of the Crop: The Contractor shall present data relative to the crop's economic importance, adaptation, agronomic and botanical classifications, important varieties and their characteristics…

Sorghum is a member of the family Poaceae, i.e., a grass. An annual crop, sorghum is planted in the late spring or early fall. In tropical and subtropical climates, more than one planting and harvest is possible in a single crop year. Sorghum grain is harvested at the end of the growing season, generally about 90 to 130 days after planting. While sorghum grain is used as a food outside the United States, in the United States sorghum grain is used primarily as a component in livestock feed.

Producers in the United States grow many different varieties of sorghum. These varieties have remarkably different growth patterns depending on the variety and environmental conditions. Some of the sorghum varieties have high soluble sugar content (sweet sorghums). Sweet sorghum contains readily fermentable sugars as well as large amounts of carbohydrate biomass in the form of starch, cellulose, or hemicellulose. Some varieties of sorghum produce tall plants with substantial amounts of complex carbohydrates (biomass sorghums and high-biomass sorghums). Ceres, a biotechnology company, reports production of high biomass sorghum plants as tall as 18 feet under favorable conditions.[4] The biomass sorghums are characterized by accumulations of cellulose, hemicellulose, and lignin. These are less easily converted to fuel by fermentation but may be burned directly or refined to produce energy products other than ethanol.

In most varieties of sweet sorghum, the primary soluble carbohydrate is sucrose, with reducing sugars and soluble starch making up a smaller portion of the soluble carbohydrates. Similar to sugarcane sap, the sap of sweet sorghum is extracted by milling. Once extracted, the sugars from sweet sorghum can be fermented to produce ethanol (a biofuel). Other products from sweet sorghum include syrup, molasses, rum (an alcoholic beverage containing ethanol) and crystalline sugar. Most of these products are excluded from the definition of a biobased product, although sorghum syrup and crystalline sorghum sugar could be used as an intermediate feedstock for production of biofuels or other biobased products.

[4] Ceres, Inc., 2014, High-Biomass Sorghum, http://www.ceres.net/Products/Products-Sorghum.html, accessed February 2015.

Over the past three and a half decades, interest in growing sorghum as an energy source has risen and fallen. These changes have been influenced by federal support programs for alternative energy sources and by changes in the price of crude oil and petroleum-based products. While petroleum-based products and sorghum biobased products are not totally fungible, sorghum bioenergy products have been presented as one alternative to some products derived from fossil energy sources.

Marketing: Describe how prices are determined.
The Contractor was unable to identify any price series for biomass sorghum and sweet sorghum grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or biobased products. It appears that refineries considering sorghum as a feedstock purchase the sorghum under contract. However, the Contractor was unable to obtain a contract for production or for purchase of these crops. Consequently, questions of insurable interest in sweet sorghum and biomass sorghum grown for the purposes established by these contracts cannot be addressed. Nor can the issue of grading standards for biomass sorghum and sweet sorghum contracts for the feedstock for renewable biofuel, renewable electricity, or biobased products contracts be addressed. Although, even in the absence of such a contract, it is reasonable to conclude that sorghum grown as a biobased product feedstock and not sold for that purpose can be used as feed.

Some stakeholders with whom the Contractor spoke indicated that the market price of grain sorghum or of sugar (depending on the type of sorghum under contract) adjusted by a basis was used for contracting of the crops. This makes economic sense: the buyers of biomass sweet sorghum and sweet sorghum grown expressly for the purposes of a feedstock for biofuels, electricity, or other biobased products must compete with the value of alternative crops to induce producers to enter into contracts for such production.

Review of Other Programs: The Contractor shall list and summarize the provisions and benefits of all state and federal programs that currently support or subsidize these producers [growing sorghum as a bioenergy or biobased product feedstock].
The Contractor identified three programs of support for sorghum grown for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or biobased products that are unusual, though not unique to the crop. The first is a Checkoff program. The second is the substantial research support provided to sweet sorghum breeding and production programs through the USDA National Institute of Food and Agriculture (NIFA). The last is the support for development of alternative energy products from a variety of federal departments and agencies. The Contractor also notes crop insurance is available for grain sorghum in most states and sorghum grown for silage in selected counties in five states. States contribute to both NIFA crop-related research and to bio-energy programs. The Contractor identified no private insurance products that would impact development of a multi-peril crop insurance product for sorghum grown as an energy or biobased product feedstock.

Data Availability and Price Methodologies: The Contractor shall conduct a search for price data at the national and regional level, and yield data in each geographic region.
As noted above, the Contractor was unable to identify any price series data for biomass sorghum and sweet sorghum grown expressly for the purposes of producing a feedstock for renewable

biofuel, renewable electricity, or biobased products. As discussed previously, the data series for grain sorghum or for sugar, as appropriate, provides the most reasonable alternative foundation for establishing a price for feedstock sorghum other than contract price. Since the Contractor was unable to obtain a contract for feedstock sorghum, the effects of quality deficiencies on prices, if such terms exist in the contracts, cannot be determined. However, especially with sweet sorghum, °Brix of sugar content is known to be important.

The Contractor was not able to find yield data in any geographic region. Consequently, the Contractor believes the most effective method to construct T-yields will be to use a factor applied to the T-yields for grain sorghum. If a biomass and sweet sorghum grown for energy and biobased products feedstock industry does develop sufficiently, it may be possible in some areas to eventually develop T-yields based on the APH databases established by producers.

Risk Analyses: The Contractor shall define the economic risks [and] classify each of the perils as insurable or uninsurable and justify the classification of the risk.
The Contractor found no evidence the risks associated with production of biomass sorghum and sweet sorghum that is grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or biobased products are materially different from those for grain and silage sorghum. The only exception is that the conditions required for pollination and grain development are not crucial for sweet and biomass feedstock sorghum production. The most effective method to estimate the frequency and severity of the important risks for these special types of sorghum will be to use expert opinion to establish factors relating the risks of various sorghum types already insured. The insurable or uninsurable perils for sweet and biomass sorghum grown as biobased products feedstocks will not be substantively different from the risks associated with other field crops. The most significant perils that can affect sweet and biomass sorghum grown as biobased products feedstocks that do not affect grain and silage sorghum are harvest and postharvest perils associated with the billeting and storage of the crops. These are uninsurable perils. In the first case they reflect management practices whose differential outcome is not an insurable risk. In the second they are post-harvest risk that are uninsurable under the terms of Section 1508(a)(2) of the Crop Insurance Act.

After careful consideration of all the feasibility standards to support development of a new crop insurance product, the Contractor has concluded it is not feasible to develop a traditional crop insurance product built on a foundation of historical production data for biomass sorghum and sweet sorghum grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products. Sufficient data for a rigorous actuarial analysis of biomass sorghum and sweet sorghum do not exist. Nonetheless, the current RMA portfolio does include two tools which may provide a pathway to coverage for losses due to natural causes for these two specialty crops. Insurance for these two crops could be provided under a written agreement to the Small Grains Crop Provisions or under the Whole Farm Revenue Protection (WFRP) to offer producers a safety net which supports production of the crops, increases the potential pool of available data for future analyses, and addresses the legislative mandate for "policies" to insure feedstock biomass and sweet sorghum. Using written agreements does not eliminate the need for a certain amount of developmental activity. The parameters of the insurance offer via the written agreement must be established. However, if a contract is required for insurance to attach, it may be possible to minimize the scope of the development effort.

Contracts are a requisite for insurance to attach for several insured crops, so this requirement is not without precedent.

I. INTRODUCTION

The Statement of Work (SOW) for Order Number D15PX00044 identifies the objectives of the contracted work as: "to obtain analysis and information to aid in the development of a crop insurance program and identify issues related to potentially providing coverage."[1] The SOW continues to describe the objectives of the first deliverable under the order: "The contractor shall produce a data gathering report that identifies any issues related to insuring the identified crop, and the most viable type of insurance plan to be developed."[2] This document is that data gathering report.

The Agricultural Adjustment Act of 1938 & Federal Crop Insurance Act [7 U.S.C. 1501 *et seq*., as amended by Public Law 113–79] provided legislative authority for the study documented in this report. The legislative mandate for the study states:

> *(A) In general — The Corporation shall offer to enter into 1 or more contracts with qualified entities to carry out research and development regarding—*
>
> *(i) a policy to insure biomass sorghum that is grown expressly for the purpose of producing a feedstock for renewable biofuel, renewable electricity, or biobased products; and*
>
> *(ii) a policy to insure sweet sorghum that is grown for a purpose described in clause (i).*
>
> *(B) Research and development — Research and development with respect to each of the policies required in subparagraph (A) shall evaluate the effectiveness of risk management tools for the production of biomass sorghum or sweet sorghum, including policies and plans of insurance that—*
>
> *(i) are based on market prices and yields;*
>
> *(ii) to the extent that insufficient data exist to develop a policy based on market prices and yields, evaluate the policies and plans of insurance based on the use of weather indices, including excessive or inadequate rainfall, to protect the interest of crop producers; and*
>
> *(iii) provide protection for production or revenue losses, or both."*[3]

Sorghum is an annual crop. According to the 2012 USDA National Agricultural Statistics Service (NASS) Census of Agriculture (Census), grain sorghum is grown for grain in 42 states within the United States. Grain sorghum, a commodity crop, is insurable under RMA's Coarse Grain Provisions (11-0041) and the Area Risk Protection Insurance - Grain Sorghum Crop Provisions (14-ARPI-0051). Silage sorghum, the other sorghum type for which RMA insurance is available, is grown in 46 states. However, insurance for this crop is currently offered in selected counties in only five states. Sorghum syrup is the main commercial product processed from sweet sorghum. Although sorghum syrup production is not documented in the published census report, the NASS Quick Stats report on the 2012 Census data reports that sorghum syrup

[1] United States Department of Interior, Interior Business Center, AQD, 2015, Requisition 0040187986, page 23 of 35.
[2] *Ibid*.
[3] Public Law 113–79 enacted February 7, 2014, has the official short title "Agricultural Act of 2014" but is also commonly known as the 2014 Farm Bill.

was produced in 19 states. In contrast, biomass sorghum is a relatively recent addition to the sorghum types planted in the United States and NASS does not currently publish data on this sorghum type.

The contract for this report indicates: "RMA is not looking for a complete feasibility study, but is looking for specific aspects needed to understand and determine what type of crop insurance program will work best for these crops, producers, and for the specific data needed to create a crop insurance program that covers producers with an optimal program."[4] However, the contract does require the Contractor to include in its analysis of technical approaches or strategies for development consideration of the criteria generally used to analyze the feasibility of a successful development effort. These criteria include:

- *The insurance product proposed for development must conform to RMA's enabling legislation, regulations, and procedures that cannot be changed;*
- *The insured's and their agents must be willing to pay the appropriate price for the insurance;*
- *The insurance product must be effective, meaningful and reflect the actual risks of the producers;*
- *The perils affecting production and/or revenue must be identified and categorized as insurable and non-insurable;*
- *Be ratable and operable in an actuarially sound manner;*
- *Contain underwriting, rating, pricing, loss measurement, and insurance contract terms and conditions;*
- *There must be an appropriate geographic distribution to ensure a sound financial insurance program;*
- *There must be enough interest for the risk to be spread over an acceptable pool of insureds;*
- *Customers must not be able to select insurance only when conditions are adverse;*
- *Moral hazards must be avoidable or controllable;*
- *There must be no change of beneficial gain, (adverse selection); and,*
- *There must be no change in market behavior or market distortions that change the quantity supplied or shift the supply curve.*[5]

These criteria therefore provide the foundation for the Feasibility Analysis section of the report.

The reminder of the report incorporates the following sections:

- Biomass Sorghum and Sweet Sorghum Crop Descriptions;
- Marketing Description;
- Review of Current Programs Supporting the Crops;
- Data Collection;
- Stakeholder Input;
- Risk Analysis;
- Feasibility Assessment; and
- Recommendations.

[4] DOI Order D15PX00044, page 24 of 35.
[5] Ibid., page 23 of 35.

II. BIOMASS SORGHUM AND SWEET SORGHUM DESCRIPTION

The SOW instructs the Contractor to provide a "Description of the Crop" as part of the Data Gathering Report. In this section, the Contractor provides a discussion of sorghum as a crop, inclusive of descriptions for the subsets of sweet sorghum and biomass sorghum. The economic footprint of sorghum as an element of the U.S. agricultural economy is described in this section. The economic and market characteristics of biomass sorghum and sweet sorghum are discussed in Section III. Marketing Description.

Sorghum

While sorghum grain is commonly used as a food outside the United States, in the United States sorghum grain is used primarily as a component in livestock feed. The United nations (UN) Food and Agriculture Organization (FAO) reports that the United States had the seventh largest sorghum acreage harvested in 2011 (the most recent year for which data are reported in the FAOSTATS tool http://faostat3.fao.org/search/*/E), after India, Sudan (including the region that became South Sudan in that year), Nigeria, Niger, Mexico, and Mali. U.S harvested acreage represents approximately 4 percent of the world acreage, while U.S. production embodies almost 11 percent of the global sorghum production.

Sorghum is a plant in the family Poacaea. Like the other plants in this family, sorghum is a grass. Cultivated sorghum is in the species *Sorghum bicolor* (L.) Moench. Sorghum grain forms on a panicle, with numerous spikelets borne on the highly branched structure in pairs. The heavy, highly branched panicle, often borne on a single stalk, encouraged cultivation where hand harvesting is typical (e.g., in America during the 19th Century and in developing economies today). However, mechanical harvesting of the grain can be easily accomplished using conventional equipment.

An annual crop, sorghum is planted in the late spring or early fall. Soil temperature is the primary limiting factor determining how early a sorghum crop can be planted. Sorghum seed needs soil temperatures above 60°F for emergence.[6] In tropical and subtropical climates, more than one planting and harvest is possible in a single crop year. Sorghum grain is harvested at the end of the growing season, generally about 90 to 130 days after planting.

Sorghum grows in a wide range of climates and soil types. It is particularly useful as a dryland crop as it generally has the ability to withstand periods of water deficit while still yielding a reasonable economic return to the producer. Four features that support this pattern are:

- A heavy, waxy cuticle;
- A large root mass to leaf surface area;
- Rolling of leaves during times of water deficit; and
- Entering dormancy under extreme water deficit.

[6] Carter, P.R., D.R. Hicks, E.S. Oplinger, J.D. Doll, L.G. Bundy, R.T. Schuler, and B.J. Holmes, 2015, Grain Sorghum (Milo), https://www.hort.purdue.edu/newcrop/afcm/sorghum.html, accessed March 2015.

U.S. sorghum producers grow many different varieties of sorghum for the different end uses.[7] The five major categories of sorghum include:

- Grain sorghum,
- Silage sorghum (for silage for animal feed),
- Forage sorghum (for forage for animal feed),
- Sweet sorghum (for syrup and as a biobased product feedstock), and
- Biomass sorghum (as fuel or a biobased product feedstock).

These varieties have remarkably different growth patterns depending on the variety and environmental conditions. Some of the sorghum varieties (sweet sorghums) have high soluble sugar content. Sweet sorghum contains readily fermentable sugars (*i.e.*, glucose, fructose, and sucrose) as well as large amounts of carbohydrate biomass in the form of starch, cellulose, or hemicellulose. In most varieties of sweet sorghum, the primary soluble carbohydrate is sucrose, with glucose, fructose and soluble starch making up a smaller portion of the soluble carbohydrates.

Sweet sorghum was originally grown in the United States for the production of syrup that was used as a sweetener. In the late 1890s, hundreds of thousands of acres of sweet sorghum were being grown for extraction of sorghum syrup in 44 states.[8] Sweet sorghum is viewed as a potential replacement for sugarcane in ethanol production in the United States.[9] It can be grown in typical sugarcane areas (Florida and moist southern portions of the Gulf States) and in areas where sugarcane cannot be grown because it is drier (Southwest region of the United States). The advent of cheaper sugars (particularly corn-based syrups) diminished sweet sorghum's role in the fermentative ethanol production industry.

Nonetheless, sweet sorghum compares well with corn and sugarcane when viewed from the perspective of the energy balance between production and available extracted energy. Sweet sorghum produces eight units of energy for every unit of energy invested in its cultivation and production. Similar comparisons are 8.3 units for sugarcane and 1.8 units for corn.[10]

Similar to sugarcane sap, the sap of sweet sorghum is extracted by milling. Once extracted, the sugars from sweet sorghum can be fermented to produce ethanol (a biofuel). Other products derived from sweet sorghum include syrup, crystalline sugar, molasses (a byproduct from the production of crystalline sugar), and rum (an alcoholic beverage containing ethanol). Most of these products are excluded from the definition of a biobased product, although sorghum syrup and crystalline sorghum sugar could be used as an intermediate feedstock for production of biofuels or other biobased products. Sweet sorghum can be used as a feedstock for synthesis of butadiene, butanol, ethanol glycol, isobutanol, isoprene, succinic acid, and 1, 3-propanediol. These chemicals can be used to produce synthetic rubber, plastics, and fibers. Significant

[7] Halsall, M. 2010, Seed World, "Boom Times for Sorghum," http://seedworld.com/boom-times-for-sorghum-seed-world-june-2014/, accessed March 2015.
[8] Randy Powell, Delta BioRenewables LLC, 2015, personal communication.
[9] BBI International, 2008, Sweet Harvest, Ethanol Producer, http://ethanolproducer.com/articles/4295/sweet-harvest/, accessed March 2015.
[10] Agriculture Business Week, 2008, Article "Sweet Sorghum : A New "Smart Biofuel Crop", http://www.agribusinessweek.com/sweet-sorghum-a-new-smart-biofuel-crop/, accessed March 2015.

investment is being made in synthesis of biobased products using processes other than traditional fermentation.[11]

A Texas A&M University report states "Sweet sorghum is a potential biofuel crop because it is capable of producing high yields of ethanol from a combination of easily fermentable sugars and lignocellulosic bagasse. The development of alternative forms of biofuels production is essential to meet the Renewable Fuel Standards (RFS) which calls for an annual production of 36 billion gallons of renewable fuels by 2022. Of the 36 billion gallons, 15 billion gallons is to come from grain based ethanol with the remaining 21 billion gallons coming from a combination of advanced biofuels and cellulosic ethanol production." [12]

The U.S. Department of Energy (DOE) defines biomass as organic matter available on a recurring basis,[13] including plants, plant-derived materials, animal manure, and municipal residues. Plant biomass can be derived from agricultural crops, trees, native grasses, and aquatic plants. Plant biomass is of particular interest because the organic chemicals in plants (carbohydrates, proteins, and lipids) store energy captured during photosynthesis. This energy can subsequently be used either by direct combustion (burning) or by conversion to solid, liquid, or gaseous fuels. The biomass can also be used as a feedstock for the production of biobased products.

The carbohydrate components of plants include simple sugars and starches in the body of the cell, and cellulose,[14] hemicellulose,[15] and lignin[16] in the cell walls. Starches can be converted to sugars through digestion. The sugars, in turn, can be converted to alcohol by the process of fermentation. This is the principal process by which corn grain ethanol (a biofuel) is produced. The cellulose, hemicellulose, and lignin contained in plants are less easily converted to biofuels than are starches. At the bio-refineries, each of these cell wall components can be used in the production of biofuels. The cellular processes that produce the biomass use energy to create progressively more complicated molecules and structures. The processes that produce biofuels break down these structures and molecules to produce fuels containing a portion of the energy originally stored in the biomass. Biodiesel and ethanol are the two most common biofuels. Biodiesel is not generally produced from non-oilseed crops. Alcohol production is generally accomplished by anaerobic fermentation, but production by catalytic, non-fermentative processes is possible.[17]

Some varieties of sorghum produce tall plants with substantial amounts of complex carbohydrates (biomass sorghums and high-biomass sorghums). Ceres, a biotechnology company reports production of high biomass sorghum plants as tall as 18 feet under favorable

[11] Shell Oil Company, 2014, Process to Produce Biofuels via Organic Phase Thermal Hydrocatalytic Treatment of Biomass, U.S. Patent 8,921,629 B2; Processor, personal communication, March 2015.
[12] Agri-Life extension, 2010, Article "Economic Analysis of Sweet Sorghum for Biofuels Production in the Texas High Plains", http://amarillo.tamu.edu/files/2011/05/Sweet-Sorghum.pdf, accessed March 2015.
[13] United States Department Of Energy, 2010, Biomass Energy Data Book: Edition 3.
[14] A linear carbohydrate polymer made of glucose molecules.
[15] A carbohydrate polymer made of a mixture of simple sugars which forms an amorphous and random mass in the cell wall.
[16] A complex cross-linked polymer made of cyclical alcoholic subunits.
[17] Shell Oil Company, 2014, Process to Produce Biofuels via Organic Phase Thermal Hydrocatalytic Treatment of Biomass, U.S. Patent 8,921,629 B2.

conditions.[18] The biomass sorghums are characterized primarily by substantial accumulations of cellulose, hemicellulose and lignin. These are less easily fermented, but may be burned directly or refined to produce biobased products other than ethanol.

Biomass sorghum is similar to sweet sorghum. However, while sweet sorghum grows with an architecture and carbohydrate distribution similar to sugarcane; biomass sorghum generally produces more complex polysaccharides and accumulates fewer simple sugars. In some areas, the biomass sorghum can be left in the field and harvested all winter using silage choppers. The harvested biomass can then be stored in pits. Biomass sorghum can also be baled and stored for longer periods of time than sweet sorghum. Grain production is not necessary for the harvest of sorghum biomass. Management to maximize grain may not result in maximal production of biomass or of the materials most important for use of sorghum as a feedstock for energy and biobased products.

Unlike many fully determinate annuals, sorghum can be managed to continue growing after the seed is harvested. Following harvest, if the stalks are cut or flailed, many sorghum varieties will branch and tiller. If weather conditions permit, this branching and tillering has the potential to produce additional vegetative growth. This secondary growth can be grazed or harvested for silage or biomass.

Grains such as corn and sorghum can be used as a feedstock for biofuel production. Grain sorghum is a minor feedstock for the bioethanol industry; it is estimated that one third of the grain sorghum crop may be used for ethanol.[19] It is important to note that cellulosic ethanol (ethanol derived from converting cellulose and other non-starch structural/cellular components) constitutes a very limited share of bioethanol production. Currently, only substantial incentive payments make cellulosic ethanol production profitable.

The Federal Crop Insurance Corporation (FCIC) offers two policies for insurance of sorghum. Grain sorghum can be insured under the Area Risk Protection Insurance - Grain Sorghum Crop Provisions (14-ARPI-0051) and the Yield Protection, Revenue Protection and Revenue Protection with Harvest Price Exclusion - Coarse Grains Crop Provisions (11-0041). Silage sorghum is covered under the Silage Sorghum Pilot Endorsement (11-0059) to the Coarse Grains Crop Provisions.

I.A Overview of Sorghum Production in the United States

The 2012 Census showed the entire U.S. agricultural economy had a value of $394 billion. Crops account for $212 billion of this economic activity.[20] Sorghum production accounted for $1.8 billion. Some sorghum production was reported in every state except Alaska and Connecticut. The majority of the sorghum value was from grain production. Sorghum for silage

[18] Ceres, Inc., 2014, High-Biomass Sorghum, http://www.ceres.net/Products/Products-Sorghum.html, accessed February 2015.
[19] United Sorghum Checkoff Program, 2012, Renewables, http://sorghumcheckoff.com/sorghum-markets/renewables/, accessed March 2015.
[20] Including nursery crops.

and green chop accounted for 5.6 million tons of the crop in 2012.[21] At sorghum silage market prices reported by Kansas State this would be worth approximately $164 million.[22] There is no breakout in the Census data for sweet sorghum or biomass sorghum production or value. Anecdotal reports suggest that producers of sweet sorghum and biomass sorghum may report the crop under the silage sorghum category.

The data available for the U.S. sorghum industry varies dramatically. Grain sorghum is the fifth largest cereal crop in the world.[23] The USDA collects substantial data on sorghum production. It is interesting to note that NASS data on acres planted (Table 1) estimated from their annual surveys documents planting in 14 states as compared to the 42 states documented in the 2012 Census.

Table 1. Sorghum Total Acres Planted by State, 2014 Crop Year

State	Acres
Arizona	25,000
Arkansas	170,000
Colorado	345,000
Georgia	40,000
Illinois	23,000
Kansas	2,850,000
Louisiana	100,000
Mississippi	110,000
Missouri	85,000
Nebraska	210,000
New Mexico	110,000
Oklahoma	370,000
South Dakota	200,000
Texas	2,500,000

Source: USDA, NASS, 2015, Quick Stats, http://quickstats.nass.usda.gov/, accessed March 2015.

NASS survey estimates for grain sorghum in 2014 include acres and production data for the 14 states with estimates on sorghum acreage planted (Table 2). NASS survey estimates for grain sorghum in 2014 also include acres and production data down to the county level for 232 counties (Appendix A). Additionally, the NASS 2012 Census includes county-level acres and production data on grain sorghum, silage sorghum, and sorghum syrup (Appendix B). Data in the published Census on silage sorghum is limited when compared to the data for grain sorghum. Since 2007, the data for silage sorghum production are published only at the state level (Table 3). However, additional data are available through the NASS Quick Stats website.

[21] USDA, 2012, Census of Agriculture, http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/st99_1_037_037.pdf, accessed March 2015.

[22] Kansas State Research and Extension, Farm Management Guide, MF648, February 2014, Forage Sorghum Silage Cost-Return Budget in South Central Kansas, http://www.ksre.ksu.edu/bookstore/pubs/mf648.pdf, accessed March 2015.

[23] Kurt Nolte, Yuma Country Extension in Arizona, 2010, Grain Sorghum, http://cals.arizona.edu/fps/sites/cals.arizona.edu.fps/files/cotw/Sorghum.pdf, accessed March 2015.

Table 2. Grain Sorghum Production by State, 2013 Crop Year

State	Acres Harvested	Production (bushels)	Yield (bushels/acre)
Arizona	8,000	800,000	100
Arkansas	165,000	16,005,000	97
Colorado	280,000	8,400,000	30
Georgia	23,000	943,000	41
Illinois	21,000	2,226,000	106
Kansas	2,700,000	199,800,000	74
Louisiana	96,000	8,928,000	93
Mississippi	105,000	8,400,000	80
Missouri	73,000	7,373,000	101
Nebraska	160,000	13,120,000	82
New Mexico	60,000	2,520,000	42
Oklahoma	310,000	17,360,000	56
South Dakota	150,000	9,450,000	63
Texas	2,250,000	137,250,000	61

Source: USDA, NASS, 2015, Quick Stats, http://quickstats.nass.usda.gov/, accessed March 2015.

Table 3. Silage Sorghum Production by State, 2014 Crop Year

State	Acres Harvested	Production (tons)	Yield (tons/acre)
Arizona	17,000	391,000	23
Arkansas	2,000	34,000	17
Colorado	10,000	110,000	11
Georgia	14,000	154,000	11
Illinois	1,000	18,000	18
Kansas	70,000	770,000	11
Louisiana	1,000	13,000	13
Mississippi	2,000	24,000	12
Missouri	10,000	170,000	17
Nebraska	20,000	240,000	12
New Mexico	33,000	429,000	13
Oklahoma	15,000	150,000	10
South Dakota	20,000	220,000	11
Texas	100,000	1,400,000	14

Source: USDA, NASS, 2015, Quick Stats, http://quickstats.nass.usda.gov/, accessed March 2015.

Kansas and Texas are the largest producers of both grain and silage sorghum. Research on sweet sorghum and biomass sorghum has been conducted in these states as well as in California, Florida, Kansas, Kentucky, Louisiana, and Texas.[24]

Over the past three and a half decades, interest in growing sorghum as an energy source has risen and fallen. These changes have been influenced by Federal support programs for alternative energy sources and by changes in the price of crude oil and petroleum-based products. While

[24] Hills, F.J., R.T. Lewellen, and I.0. Skoyen, 1990, Sweet sorghum cultivars for alcohol production, California Agriculture 44:14-16, http://ucanr.edu/repositoryfiles/ca4401p14-69434.pdf; Amosson, S, J. Girase, B. Bean, W. Rooney, and J. Becker, 2011, Economic Analysis of Sweet Sorghum for Biofuels Production in the Texas High Plains, http://amarillo.tamu.edu/files/2011/05/Sweet-Sorghum.pdf; Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, 2011, Production of Biofuel Crops in Florida: Sweet Sorghum, http://edis.ifas.ufl.edu/ag298; Pfeiffer, T., 2013, Sweet Sorghum for Syrup, http://www.uky.edu/Ag/CCD/introsheets/swsorghumintro.pdf; accessed March 2015.

petroleum-based products and sorghum biobased products are not totally fungible, sorghum bioenergy products have been presented as one alternative to some products derived from fossil energy sources.

III. MAKETING DESCRIPTION

The SOW instructs the Contractor to provide a marketing description in accordance with the following description:

> *"Describe how prices are determined. If prices are determined by contract, copies of the entire contract shall be provided. Establish the insurable interest of the producer. In a given region, the Contractor shall describe if there are critical time periods to market the crop, and include the optimal or preferred time for producers to sign contracts. The Contractor shall also identify… grading standards; present,* [and] *if applicable, alternative uses for the reduced quality crop. Determine the impact of any Federal Marketing Order, if applicable, on the plan of insurance."*

The Contractor was unable to identify any price series data for biomass sorghum and sweet sorghum grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products. Discussion with staff and owners of biofuel refineries as well as investigation of biofuel company websites indicate refineries considering the use of sorghum as a feedstock make their purchases of these feedstocks under contractual agreements. However, the Contractor was unable to obtain a contract for production or for purchase of these crops. Consequently, questions of insurable interest in sweet sorghum and biomass sorghum grown for the purposes established by these contracts cannot be addressed. Nor can the issues of grading standards for biomass sorghum and sweet sorghum contracts for the feedstock for renewable biofuel, renewable electricity, or bio-based products contracts be addressed from a data supported position. Alternative markets available for the producer to realize some return on their crop include the: animal feed market, food flavoring market, crystal sugar extraction market, alcoholic beverage production market, and liquid table sweetener market. It is reasonable to conclude that sorghum grown as a bio-based product feedstock and not sold for that purpose because of quality issues can be used as feed. Each of these alternative markets is primarily local rather than being a regional or national market.

Discussion with producers of sweet sorghum and representatives from the alternative energy industry revealed that, for these operations, contracts were primarily based on one of two proxies: local market prices for silage sorghum and the price of sugar. In the first case, contract prices are based on a silage sorghum price plus a negotiated premium to ensure delivery of the product to the refinery or mill (if contracted for sugar extraction). In the second case, producers are consistently searching to realize the best return on their investment (ROI) for the crops they produce. For sweet sorghum, this ROI value is based primarily on the market value applied to granulated sugar. A base value for a pound of sugar was used as the benchmark for contracting sweet sorghum prices in three separate conversations.

While grading standards were never mentioned and the Contractor's research found no specific references to grading standards for either biomass sorghum or sweet sorghum, anecdotal evidence provided by producers and bioenergy industry representatives suggested premiums based on the °Brix in the juice extracted from the sweet sorghum stalk will likely be encountered. °Brix is a commonly used refractometer scale for measuring solids (in this case – sugars) dissolved in water by weight. One °Brix equals one percent. Hence, a 16 °Brix solution in extracted sweet sorghum juice indicates that 16 percent of the juice is some form of sugar.

While this is not completely accurate as there are other contaminants in the unrefined juice, the bioenergy industry uses 16 °Brix as the standard for basing premiums in its contracts with producers. If the producer delivers sweet sorghum that provides 18 °Brix, the producer receives a premium and if that sweet sorghum provides 14 °Brix, the producer's payment is discounted. As stated previously, the Contractor was unable obtain a copy of a production contract. Consequently, the level of premium or discount cannot be documented for this report. However, the Contractor notes that the definition of contract price in the various policies that allow use of a contract price always exclude premiums and discounts from the price allowed under the crop insurance policy.

The Contractor found no evidence of Federal Marketing Orders for sorghum. However, the Commodity Promotion, Research, and Information Act of 1996 established the Sorghum Promotion, Research, and Information Program, commonly known as the Sorghum Checkoff Program. The Sorghum Checkoff Program supports generic promotion of the crop, research (including research on alternative uses of the crop), and activities aimed at advancing the demand for sorghum to benefit U.S. producers and consumers. The USDA Agricultural Marketing Service (AMS) published a final Sorghum Promotion, Research, and Information Order on May 6, 2008. That order took effect May 7, 2008, with the first collection of assessments on July 1, 2008.

Potential Impact of the Proposed Program on Agricultural Markets

Grains such as corn and sorghum can be used as a feedstock for biofuel production. Grain sorghum is a relatively minor feedstock for the bioethanol industry; it is estimated that one third of the grain sorghum crop may be used for ethanol.[25] It is important to note that cellulosic ethanol (ethanol derived from converting cellulose and other non-starch structural/cellular components) constitutes a very limited share of bioethanol production. Anecdotal evidence indicates the producers of biomass sorghum and sweet sorghum plant small amounts (generally less than 10 acres) of the crop for use as forage or silage or, in the case of sweet sorghum, for personal use and/or local distribution of the sorghum syrup.

Biomass sorghum and sweet sorghum are not recently introduced crops in the U.S. agricultural economy. However, their use as a feedstock for bio-based products is very limited. Determining and identifying the potential impacts of offering an insurance product for these crops is fraught with uncertainty as a result. Any incentive provided by the Federal government, whether that be in the form of insurance or subsidies, will have an impact on the number of acres planted, the number of producers planting the crop, and the economic market for the product.

As access to water for irrigation becomes more and more problematic, sweet sorghum or biomass sorghum may become a more economically viable alternative. Additionally, recent movement at the federal legislative level indicates dissatisfaction with the current subsidies provided for corn for ethanol under the Renewable Fuels Standard.[26] Couple these issues with

[25] United Sorghum Checkoff Program, 2012, Renewables, http://sorghumcheckoff.com/sorghum-markets/renewables/, accessed September 2014.

[26] Dianne Feinstein, United States Senator for California, Press Release, "Feinstein, Toomey Introduce Amendment to End Corn Ethanol Mandate", http://www.feinstein.senate.gov/public/index.cfm/press-releases?ID=6cb82ce8-ba16-4006-b812-05a8bb8592ce, accessed March 2015.

renewed interest in alternative sources of feedstock for bio-based products by the energy industry and the reported energy return for sweet sorghum (8:1) versus that for corn (1.8:1), there appears to be the possibility of increases of biomass sorghum and sweet sorghum acreage in the next several years. Introduction of insurance may provide yet another factor to support such an increase. Availability of subsidized insurance would place biomass sorghum and sweet sorghum on par with other crops the producer could plant.

Biomass sorghum and sweet sorghum have a high ratio of bulk to value. Therefore, it is expensive to transport the crop. Feedstock sorghum is best suited for production near processing facilities (e.g., 20 – 25 miles).[27] Further, it is best suited to a relatively short storage period prior to processing so lengthy transportation periods are detrimental to the value of the crop. This factor constitutes the primary limitation with regard to the areas where feedstock sweet sorghum can be grown. Due to these characteristics of the crops, any producer who attempts to grow either crop in the absence of livestock ownership or sales arrangements made prior to planting may not have a market for the biomass sorghum or sweet sorghum once it is produced.

Many crops are insurable in the counties where the grain sorghum insurance product is currently offered and written agreements could be introduced for biomass sorghum and sweet sorghum. These crops primarily include wheat, grain sorghum, soybeans, and corn for grain and silage. Sugarcane is another insurable crop in some of these regions. In many cases, such as the Coarse Grains Crop Provisions, a statement on the Special Provisions would be needed to amend section 8(d) of those crop provisions.

Producers who grow biomass sorghum or sweet sorghum for local sweet syrup sales or to feed livestock on their own farms do not have incentives to increase the acreage beyond their own needs. Conversely, those producers who grow biomass sorghum and sweet sorghum under contract do have an incentive to increase production as the demand from the industry increases. Since the renewable fuel standard (RFS) requires 15 billion gallons of ethanol be produced by 2015 using grain (corn) as the base and by 2022 an additional 21 billion gallons using a combination of advanced biofuels and cellulosic ethanol production (within which biomass sorghum and sweet sorghum fall), there is a strong impetus for the energy industry to increase demand for these crops to fulfill this legislative mandate.

WFRP and written agreements based on the grain sorghum insurance policy provide producers of biomass sorghum and sweet sorghum an opportunity to use a safety net to protect them from the consequences of adverse natural conditions beyond their control. This opportunity currently does not exist for losses otherwise covered by multiple peril crop insurance authorized by the Federal Crop Insurance Act.

Potential Impacts of Proposed Biomass Sorghum and Sweet Sorghum Approach on Small and Limited Resource Farmers

Most production of sweet sorghum is machinery-intensive (and hence, capital intensive), requiring a harvester (currently a modified sugarcane harvester is used by the producers with whom the Contractor spoke) and a tractor/trailer combination to remove the product from the

[27] Aaron Pepper, Southeast Renewable Fuels, LLC, 2015, personal communication.

field once harvested. Additional haul trucks with trailers are necessary to transport the product from the field to the processing facility. The number of such vehicles depends on the distance the billeted material is hauled. Each tractor and truck requires an operator, so substantial labor is needed in a short period. The sweet sorghum must be harvested during a limited period to assure the most sugar content in the product. Small and limited resource producers do not likely possess the necessary equipment for production and they may not have access to the labor required for harvesting.

In contrast, one operator can harvest biomass sorghum because the harvesting period can occur over a more extended period. Additionally, biomass sorghum can be stored for longer periods prior to delivery to the processing facility which reduces some of the labor requirements and some of the capital costs of transportation.

The Contractor suspects that small and limited resource farmers are likely to refrain from planting acreage of biomass sorghum and sweet sorghum until the market will support additional machinery purchases by these producers. On the other hand, availability of insurance may encourage these producers to seek contracts for sale of biomass sorghum or sweet sorghum on a "standing crop" basis. Under a "standing crop" contract, the buyer is responsible for harvesting the crop and transporting it to the delivery point. In this case, limited resource farmers would have additional opportunities for income-producing activity.

IV. REVIEW OF CURRENT PROGRAMS

The SOW instructs the Contractor to "list and summarize the provisions and benefits of all state and federal programs that currently support or subsidize these producers…also…describe any private insurance program that is available to these producers…note any gaps in coverage and constraints of the private insurance programs, if applicable." The Contractor reviewed federal and state-level programs supporting the production of feedstock for bio-product manufacture and investigated private insurance products providing risk mitigation for producers of bio-product feedstock. This section provides a discussion of the results of these efforts.

The Contractor identified three programs of support for sorghum grown for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products that are unusual, though not unique to the crop. The first is the Checkoff program. The Commodity Promotion, Research, and Information Act of 1996 established the Sorghum Promotion, Research, and Information Program, commonly known as the Sorghum Checkoff Program. The Sorghum Checkoff Program supports generic promotion of the crop, research (including research on alternative uses of the crop), and activities aimed at advancing the demand for sorghum to benefit U.S. producers and consumers. AMS published a final Sorghum Promotion, Research, and Information Order on May 6, 2008. That order took effect May 7, 2008, with the first collection of assessments on July 1, 2008.

The second unusual programs of support for sorghum grown for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products is the substantial research support provided to sweet and sorghum breeding and production programs for sorghum through the USDA National Institute of Food and Agriculture (NIFA). NIFA was formerly known as the Cooperative State Research, Education, and Extension Service (CSREES). NIFA supports a wide range of research efforts. Their focus in some of their grant opportunities on bioenergy and in others on sorghum has provided a synergy that has led to numerous proposals for research and development of pilot programs for crop production and refining of sorghum feedstocks.

The last unusual support program is the support by a variety of federal departments and agencies for development of alternative energy products. For decades, biofuels have been touted as a replacement for fossil fuels. The Biomass and Alcohol Fuels Act of 1980, signed by President Carter, called for "a national program for increased production and use of biomass energy that does not impair the Nation's ability to produce food and fiber …"[28] Under this act, the Office of Alcohol Fuels in the Department of Energy was required to prepare quarterly reports for the President and Congress on the progress toward these national goals. Public Law 99-386 decreased the frequency of these reports; they were prepared annually until 2000. The requirements for reporting on these specific goals were repealed under section 3003 of Public Law 104-66. However, the change in reporting requirements does not reflect any loss of interest by Congress in alternative fuels.

[28] 42 USC 8801, 1980, Historical Crude Oil Prices and Price Chart, http://www.infomine.com/investment/metal-prices/crude-oil/all/, accessed February 2015.

More than two dozen programs have been established since 1980. They have been administered by five government entities: the Environmental Protection Agency (EPA), USDA, the Department of Energy (DOE), the Internal Revenue Service (IRS), and the U.S. Customs and Border Protection now an element of the Department of Homeland Security. Public Law 109-58 (2005) and Public Law 110-140 (2007) and the 2008 and 2014 Farm Bills (Public Laws 110-246 and 113-79) all had elements promoting alternative fuels. However, many of the incentives for biofuels production supported by these laws have expired (Appendix C).

The RFS established under Public Law 109-58 (2005) mandated biofuels use; Public Law 110-140 (2007) significantly expanded the mandate. In 2006, Congress required the use of 4 billion gallons of renewable fuel. While the amount of renewable fuel was originally mandated to increase to 7.5 billion gallons in 2012, that mandate was superseded by the RFS which required 20.5 billion gallons of renewable fuel in 2015 and 36 billion gallons in 2022. Furthermore, after 2015 the increases in renewable fuels must come from advanced biofuels (such as cellulosic ethanol,[29] butanol refined from sugar, and biodiesel).

Federal law establishes requirements that certain renewable fuels must reduce lifecycle greenhouse gas emissions below the emissions from petroleum-based fuels sold in 2005. For example, transportation fuel produced from facilities that commence construction after the date of enactment for the 2007 legislation qualifies as renewable fuel only if it achieves at least a 20 percent reduction in greenhouse gas emissions.[30] In addition, to qualify as an advanced biofuel, a transportation fuel must reduce lifecycle greenhouse gas emissions by at least 50 percent.[31] Cellulosic biofuels must reduce greenhouse gas emissions by at least 60 percent.

Federal law prescribes the general method the EPA must use to determine whether a biofuel qualifies as an advanced or cellulosic biofuel. According to federal law, lifecycle greenhouse gas emissions must include emissions from "all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer."[32] In addition, the emissions must include all "direct emissions and significant indirect emissions such as significant emissions from land use changes."[33] The EPA is currently developing regulations for determining the exact methods to be used in making this calculation.

[29] Cellulosic biofuel is derived from the non-starch complex carbohydrates in biomass such as sweet and biomass sorghum. This contrasts with starch-based ethanol produced from grain. Biodiesel derived from vegetable oils (including grain oils) is also considered an advanced biofuel process.
[30] Congressional Research Service, Randy Schnepf, Brent D. Yacobucci, "Renewable Fuel Standard (RFS): Overview and Issues", March 14, 2013, http://www.ifdaonline.org/IFDA/media/IFDA/GR/CRS-RFS-Overview-Issues.pdf, accessed March 2015.
[31] Ibid
[32] United States Code 7545, 2006 Edition, Supplement IV, Title 42. The Public Health and Welfare, accessed March 2015.
[33] Energy Independence and Security Act of 2007, Clean Air Act Section 211(o)(1)

The substantial Congressional activity related to ethanol is evident in the numerous bills introduced.[34] A brief overview of some of the current federal laws and mandated incentives as described on the U.S. Department of Energy Alternative Fuels Data Center[35] follows:

Advanced Biofuel Feedstock Incentives

"*The Biomass Crop Assistance Program (BCAP; Section 9010) provides financial assistance to landowners and operators that establish, produce, and deliver biomass feedstock crops for advanced biofuel production facilities. Qualified feedstock producers are eligible for a reimbursement of 50% of the cost of establishing a biomass feedstock crop, as well as annual payments for up to five years for herbaceous feedstocks and up to 15 years for woody feedstocks. In addition, BCAP provides qualified biomass feedstock crop producers matching payments for the collection, harvest, storage, and transportation of their crops to advanced biofuel production facilities for up to two years. The matching payments are $1 for each $1 per dry ton paid by a qualified advanced biofuel production facility, up to $20 per dry ton. This program is funded through fiscal year 2018 (verified February 2014), but is subject to Congressional appropriations thereafter.*

The U.S. Department of Agriculture must submit a progress report to Congress on or before February 7, 2018, communicating best practices and other relevant information gathered from BCAP participants.

For more information, see the Biomass Crop Assistance Program website. (Reference H.R. 2642, 2014 and 7 U.S. Code 8111)"[36]

Advanced Biofuel Production Payments

"*Through the Bioenergy Program for Advanced Biofuels (Section 9005), eligible producers of advanced biofuels, or fuels derived from renewable biomass other than corn kernel starch, may receive payments to support expanded production of advanced biofuels. Payment amounts will depend on the quantity and duration of production by the eligible producer; the net nonrenewable energy content of the advanced biofuel, if sufficient data is available; the number of producers participating in the program; and the amount of funds available. No more than 5% of the funds will be made available to eligible producers with an annual refining capacity of more than 150 million gallons of advanced biofuel. This program is funded through fiscal year 2018 (verified February 2014), but is subject to congressional appropriations thereafter. For more information, see the Bioenergy Program for Advanced Biofuels website and contact the appropriate*

[34] See for example the 817 proposed bills revealed by the Congress.gov search for "ethanol," https://www.congress.gov/search?q=%7B%22source%22%3A%22legislation%22%2C%22search%22%3A%22%5C%22ethanol%5C%22%22%7D

[35] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Alternative Fuels Data Center, http://www.afdc.energy.gov/laws/fed_summary, accessed March 2015.

[36] Ibid, http://www.afdc.energy.gov/laws/10292, accessed March 2015.

State Rural Development Office. (Reference Public Laws 113-79 and 112-240, and 7 U.S. Code 8105)"[37]

Biomass Research and Development Initiative

"*The U.S. Department of Agriculture's National Institute of Food and Agriculture, in conjunction with U.S. Department of Energy's Office of Biomass Programs, provides grant funding for projects addressing research, development, and demonstration of biofuels and biobased products and the methods, practices, and technologies for their production, under the Biomass Research and Development Initiative (Section 9008). The competitive award process focuses on three main technical areas: feedstock development; biofuels and biobased products development; and biofuels development analysis. Eligible applicants are institutions of higher learning, national laboratories, federal research agencies, private sector entities, and nonprofit organizations. The non-federal share of the total project cost must be at least 20%. Renewable biomass is defined as materials, pre-commercial thinnings, or invasive species on National Forest System land that qualify as byproducts of preventative treatments, are harvested in accordance with applicable laws, and would not otherwise be used for higher-value products, as well as naturally reoccurring organic matter on non-federal or non-tribal lands, including renewable plant material, feed grains, other plants and trees, algae, and vegetable and animal waste material and byproducts. Funding is authorized for this program through fiscal year 2017 (verified November 2014), but is subject to congressional appropriations thereafter. For more information, see the Biomass Research & Development website. (Reference H.R. 2642, 2014, and 7 U.S. Code 8108)*"[38]

Value-Added Producer Grants (VAPG)

"*Value-Added Producer Grants (VAPG) are available to help independent agricultural producers enter into or expand value-added activities, including innovative uses of agricultural projects, such as biofuels production. Eligible applicants include independent producers, farmer and rancher cooperatives, agricultural producer groups, and majority-controlled producer-based business ventures. Participants may apply for either a planning grant or a working capital grant, but not both. In addition, no more than 10% of program funds may be awarded to majority-controlled producer-based business ventures. Grants are awarded to projects determined to be economically viable and sustainable. For more information about grant eligibility, see the VAPG website and contact the appropriate State Rural Development Office. This program is funded through fiscal year 2018 (verified February 2014), but is subject to congressional appropriations thereafter. (Reference H.R. 2642, 2014, Section 6203; and 7 U.S. Code 1632a)*"[39]

[37] Ibid, http://www.afdc.energy.gov/laws/8503, accessed March 2015.
[38] Ibid, http://www.afdc.energy.gov/laws/378, accessed March 2015.
[39] Ibid, http://www.afdc.energy.gov/laws/379, accessed March 2015.

Renewable Fuel Standard (RFS) Program

"*The national RFS Program was developed to increase the volume of renewable fuel that is blended into transportation fuels. As required by the Energy Policy Act of 2005, the U.S. Environmental Protection Agency (EPA) finalized RFS Program regulations, effective September 1, 2007. The Energy Independence and Security Act of 2007 (EISA) increased and expanded this standard. By 2022, 36 billion gallons of renewable fuel must be blended into domestic transportation fuels each year. A certain percentage of this renewable fuel must be advanced biofuel, which includes fuels derived from approved renewable biomass, excluding corn starch-based ethanol. Other advanced biofuels may include sugarcane-based fuels, renewable diesel co-processed with petroleum, and other biofuels that may exist in the future. All advanced biofuels must achieve a minimum of a 50% greenhouse gas (GHG) emissions reduction compared to baseline petroleum emissions. Nested within advanced biofuels are two sub-categories: cellulosic biofuel and biomass-based diesel, both of which have their own percentage requirements. Cellulosic biofuel is defined as any renewable fuel derived from cellulose, hemicellulose, or lignin that achieves a 60% GHG emissions reduction. Biomass-based diesel is defined as a renewable transportation fuel, transportation fuel additive, heating oil, or jet fuel, such as biodiesel or non-ester renewable diesel, and achieves a 50% GHG emissions reduction. If intended for use in a motor vehicle, the fuel must also be registered with EPA as a motor vehicle fuel or fuel additive.*

Each year, EPA determines the annual percentage standards by dividing the annual amount of renewable fuel (gallons) required by EISA for each renewable fuel pathway by the amount of highway and nonroad gasoline and petroleum diesel estimated to be supplied that year. These percentages are then applied to obligated parties' actual fuel sales to determine their Renewable Volume Obligation (RVO). Any party that produces gasoline for use in the United States, including refiners, importers, and blenders (other than oxygenate blenders), is considered an obligated party under the RFS Program. Parties that do not produce, import, or market fuels within the 48 contiguous states are exempt from the renewable fuel tracking program.

To facilitate and track compliance with the RFS, a producer or importer of renewable fuel must generate Renewable Identification Numbers (RINs) to represent renewable fuels produced or imported by the entity on or after September 1, 2007, assigned by gallon or batch. Assigned RINs are transferred when ownership of a batch of fuel occurs, but not when fuel only changes custody. A trading program is in place to allow obligated parties to comply with their annual RVO requirements through the purchase of RINs. Obligated parties must register with EPA in order to participate in the trading program. For each calendar year, an obligated party must demonstrate that it has sufficient RINs to cover its RVO. RINs may only be used for compliance purposes in the calendar year they are generated or the following year. Obligated parties must report their

ownership of RINs to EPA's Office of Transportation and Air Quality on a quarterly and annual basis.
For more information, see the RFS Program website.

(Reference 42 U.S. Code 7545(o) and 40 CFR 80.1100-80.1167)"[40]

Additionally, several states independently have passed programs to promote production of biofuel feedstock. Following are a sample of a few of these programs in select states. For further information, please visit the DOE website at http://www.afdc.energy.gov/laws/state. A list of state and federal laws and incentive programs are provided in Appendix D.

Florida

Biofuels Investment Tax Credit

"*An income tax credit is available for 75% of all capital, operation, maintenance, and research and development costs incurred in connection with an investment in the production, storage, and distribution of biodiesel (B10-B100), ethanol (E10-E100), or other renewable fuel in the state, up to $1 million annually per taxpayer and $10 million annually for all taxpayers combined. Costs associated with retrofitting gasoline fueling station dispenser retrofits for B10-B100, E10-E100, or other renewable fuel distribution also qualify. Taxpayers must incur costs between July 1, 2012, and June 30, 2016. If the credit is not fully used in any one tax year, the unused amount may be carried forward through December 31, 2018. Beginning January 1, 2014, any entity that is allowed the investment tax credit may transfer the credit, in whole or in part, to any taxpayer by written agreement without transferring ownership interest in the qualified property. Renewable fuel is defined as a fuel produced from biomass that is used to replace or reduce conventional fuel use. (Reference Florida Statutes 212.08 and 220.192)*"[41]

Provision for Renewable Fuels Investment

"*To create jobs and improve the state's general infrastructure, the Florida State Board of Administration may invest up to 1.5% of the net assets of the system trust fund in technology and growth investments of businesses operating in Florida, including businesses related to biofuels, renewable energy, and other related applications. (Reference Florida Statutes 215.47)*"[42]

California

Support for Advance Biofuel Development

"*The California Legislature urges the U.S. Congress or the U.S. Environmental Protection Agency to take action to amend the U.S. Renewable Fuel Standard to favor non-food crop biofuel feedstocks and promote the development of advanced*

[40] Ibid, http://www.afdc.energy.gov/laws/390, accessed March 2015.
[41] Ibid, http://www.afdc.energy.gov/laws/6074, accessed March 2015.
[42] Ibid, http://www.afdc.energy.gov/laws/6424, accessed March 2015.

fuels, such as cellulosic ethanol. (Reference Assembly Joint Resolution 21, 2013)"[43]

Louisiana

Biofuels Feedstock Requirements

"*Renewable fuel production plants operating in Louisiana and deriving ethanol from the distillation of corn must use corn crops harvested in Louisiana to meet at least 20% of the facility's total feedstock requirement. Renewable fuel plants operating in Louisiana and deriving biodiesel from soybeans and other crops must use soybean crops harvested in Louisiana to meet at least 2.5% of the facility's total feedstock requirement. In succeeding years, the minimum percentage of Louisiana-harvested corn and soybeans used to produce renewable fuel in Louisiana facilities must be at least the same percentage of corn and soybeans used nationally to produce renewable fuel as reported by the U.S. Department of Agriculture's Office of the Chief Economist. To ensure that the appropriate amounts of Louisiana-harvested feedstocks are available for renewable fuel production, renewable fuel manufacturing facilities are responsible for communicating their anticipated production levels and specific feedstock requirements to the Department of Agriculture and Forestry 180 days before the start of commercial operation and on an annual basis thereafter. Additionally, all renewable fuel manufacturing plants must provide an annual report to the state that includes certification that the plant has purchased Louisiana feedstock; production levels; the amount, type, and origination of feedstock used; and any financial benefits the state has provided, including grants, financing, and exemptions. (Reference Louisiana Revised Statutes 3:3712)*"[44]

Minnesota

Cellulosic Ethanol Investment Tax Credit

"*A tax credit is available for investments in a qualified small business that uses or is involved in the research or development of a proprietary technology related to cellulosic ethanol. The tax credit is equal to 25% of the qualified investment, up to $250,000 annually. The credit is available for an investment of up to $1 million over the life of a qualified small business. Eligible small businesses must receive state certification and meet other requirements, such as being headquartered in Minnesota. The tax credit expires January 1, 2015. (Reference Minnesota Statutes 13.4967 and 116J.8737)*"[45]

Other Programs of Support for Feedstock Sorghum

Producers of feedstock sorghum can avail themselves of a variety of support programs from the federal, state, and private sectors. Some of these programs specifically address risk. Most assist in risk management by providing information that allows the producer to make informed

[43] Ibid, http://www.afdc.energy.gov/laws/11160, accessed March 2015.
[44] Ibid, http://www.afdc.energy.gov/laws/6104, accessed March 2015.
[45] Ibid, http://www.afdc.energy.gov/laws/8540, accessed March 2015.

decisions. Programs available to feedstock sorghum production operations and available purchased risk management programs supporting individual operations are addressed in this section of the report.

Federal Programs

Federal programs are offered primarily by agencies of the USDA serving the sorghum feedstock industry. Producers of feedstock sorghum are not eligible for marketing loans, price supports, or any direct payments based on current or historical production.

Agricultural Marketing Service (AMS)

Producers of feedstock sorghum benefit from general services of the AMS including the following programs:

- Promotion and Research;
- Marketing and Economic Research; and
- Plant Variety Protection Act (PVPA).

Recent support from AMS, in conjunction with state extension services, has addressed potential markets for sorghum. AMS also provides support for extension research into disease prevention, including management of disease vectors which is generally applicable to crops. The PVPA[46] is a U.S. intellectual property statute giving breeders up to 25 years of control over new, distinct, uniform, and stable sexually-reproduced or tuber-propagated varieties, protection similar to that available through patents. Some new varieties of feedstock sorghum are protected under this act.

Animal and Plant Health Inspection Service (APHIS)

APHIS is responsible for protecting and promoting U.S. agricultural health. APHIS has been tasked with responsibility for enforcing the obligations of the United States under phytosanitary rules such as the *Codex Alimentarius,* responding to plant health import requirements of other countries, and assisting in negotiating science-based trade restrictions. APHIS programs protect producers of crops by maintaining a safe environment for production.

Economic Research Service (ERS)

ERS provides data and analysis on product supply and demand, as well as information on industry structure, pricing, trade, production policies, production systems, and processing. Several ERS publications on alternate fuels mention sweet sorghum and/or biomass sorghum. There is limited information in these reports for the producer, and none focused on risk.

Farm Service Agency (FSA)

FSA provides financial assistance to producers facing losses from natural disaster (i.e., drought, flood, fire, freeze, tornadoes, pest infestation, and other "calamities"). FSA's Noninsured Crop Disaster Assistance Program (NAP) provides payments to producers of non-insurable crops when low yields, loss of inventory, or prevented planting occur due to a natural disaster. Eligible producers include landowners, tenants, and sharecroppers who share in the risk of producing an eligible crop. The average non-farm adjusted gross income of the producer cannot exceed $500,000. A payment limitation of $100,000 per individual or entity per crop year applies. The natural disaster causing the loss must occur before or during harvest and must directly affect the

[46] 7 U.S.C. 2321-2582

eligible crop. The specific rules for inclusion of production under the FSA programs are contained in 7 CFR 1437.303.[47]

FSA's Supplemental Revenue Assistance Payments (SURE) Program provided benefits to producers for 2008 through 2011 crop year farm revenue losses due to natural disasters. It was the successor to earlier *ad hoc* crop disaster programs. Beginning in 2009 through September 2011, producers or legal entities whose average non-farm income exceeded $500,000 were not eligible. A "farm" was eligible for a SURE payment when a portion of the farm was located in a county covered by a qualifying natural disaster declaration (USDA Secretarial Declarations only) or a contiguous county, or the actual production was less than 50 percent of the normal production. A producer must have obtained available purchased risk management instruments for **all** crops of economic significance[48] through either the Federal Crop Insurance Act (Act) or NAP as a condition of eligibility. The farm's SURE guarantee could not exceed 90 percent of the expected revenue for the farm (i.e., there was a 10 percent deductible). Producers must have suffered a 10 percent production loss to at least one crop of economic significance on the farm in order to be eligible for a SURE payment. A qualifying loss must have been caused by a natural disaster. A limit of $100,000 applies to the combination of payments from SURE. The Contractor is not aware of any disaster relief being claimed by feedstock sorghum producers.

Foreign Agricultural Service (FAS)

FAS maintains internet links to resources for producers. These links focus on sites that identify production practices and data, including the UN FAO import and export data. The Contractor did not locate any FAS links related to the feedstock sorghum.

National Agricultural Statistics Service (NASS)

NASS is the primary data collection and publication service of the USDA. Its data series are widely used by producers, businesses, and researchers. Limited sorghum syrup acreage and farm numbers data are collected as part of the Census of Agriculture. No feedstock sorghum data have been collected in past Census survey documents.

Risk Management Agency

WFRP policies are available to some feedstock sorghum producers. These insurance policies provide whole farm revenue insurance coverage based on a producer's Schedule F of the IRS Form 1040 tax return. These plans of insurance protect producers from revenue losses resulting from unavoidable natural disasters and from market fluctuations. Most farm-raised crops, including sorghum production, are eligible to be insured under these plans. WFRP policies can be used alone or in conjunction with other federal crop insurance plans. Feedstock sorghum is not insured as a named crop and would logically be insured under the other crops commodity code.

Rural Development (RD, formerly Rural Business–Cooperative Service (RBS))

RD is a small agency with limited funding and staff whose purpose is to finance and facilitate development of small and emerging private business enterprises, and promote sustainable

[47] CFR, Title 7, Subtitle B, Chapter XIV, Subchapter B, Part 1437, Subpart D, Section 1437.303.
[48] A crop of economic significance contributes at least five percent of the expected revenue for a producer's farm.

economic development in rural communities.[49] This agency could potentially serve producers of feedstock sorghum. However, the Contractor was unable to identify any RD programs supporting feedstock sorghum production.

State Government Programs

State programs and regulations affect feedstock sorghum production. Some states have regulations that replace or complement federal phytosanitary or environmental standards. The various regulations are similar to federal standards, often referencing them as minima. The purpose of these regulations is to reduce risks of diseases and the vectors that carry those diseases. States also provide support for the NIFA programs.

Private Insurance Inventory

Private insurance companies offer coverage to commercial sorghum feedstock operations; available coverage is described below. These products do not mirror the structure of any existing FCIC insurance. Instead these products focus on limited, producer-identified, named perils.

Weather Insurance Coverage

Private weather insurance is available from a number of traditional and online insurance companies. These products are often reinsured by major reinsurance companies (e.g., Munich Re, Swiss Re, Renaissance Re, etc.). The policies are generally "one off" contracts, customized to reflect specific named perils identified by the insured. This insurance can be structured to cover any one weather event (e.g., extreme cold or excessive rainfall) or combinations of weather the producer chooses from available options. These policies have relatively high premiums, are not subject to premium subsidies, and cover losses only from the specific named perils.

Basic Business Liability

Basic business liability insurance is available. Business liability coverage does not provide any insurance on a growing crop.

Employers Contingent Liability

Employers Contingent Liability is available with the ability to add employees as insureds. Contingent liability does not provide any coverage on a growing crop.

[49] USDA, RD, 2011, Business, http://www.rurdev.usda.gov/Business.html, accessed May 2011.

V. DATA COLLECTION

The Contractor conducted an extensive search for price and yield data at the national and regional level, with a focus on geographic regions where refineries using sweet or biomass sorghum as a feedstock were contemplated. The search targeted both quantitative and testimonial data. The data collection from testimony is documented in the Stakeholder Input section of this report.

The Contractor searched for quantitative data on sweet or biomass sorghum for energy and bio-based product production from sources recognized by the government as appropriate. The actuarial community also uses the source of quantitative data as one measure of data quality in its actuarial analysis. The contract for this study defines acceptable data sources as follows:

> *Publications and data of the RMA, FSA, NIFA* [National Institute of Food and Agriculture], *NASS and other agencies of the USDA; marketing and promotion organizations, supported by public funds or a check-off system; State Departments of Agriculture; any grower organization or association, whose membership represents 15 percent of growers in the area the organization or association serves; any generally recognized authoritative or professional journal or magazine; any other source approved by RMA, such as schools of higher education, international agencies, (FAO or the World Bank; growers' organizations or associations whose membership is representative of growers in one or more areas); and farm level data subject to review by qualified crop insurance experts.*[50]

In spite of the Contractor's extensive search for price and yield data at the national and regional level, no quantitative data series for these attributes was obtained.

RMA collects data on grain sorghum and silage sorghum. The grain sorghum data are collected from Alabama, Arizona, Arkansas, California, Colorado, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin. The silage sorghum data are collected from selected counties in Colorado, Kansas, New Mexico, Oklahoma, and Texas. RMA does not publish data on sweet or biomass sorghum for energy and bio-based product production, risks, or prices. The inclusion of data on some varieties of sweet sorghum and biomass sorghum in the RMA data for grain sorghum and silage sorghums was inferred from comments made by some producers and extension agents. However, preliminary consideration of the RMA unpublished data led the Contractor to conclude there is no way to mine the RMA data for relevant data focused exclusively on sweet and biomass sorghum grown as a feedstock for energy and bio-based products.

FSA collects information from producers about agricultural production. If these data were collected for all crops by a consistent methodology, they might be mined for data on sweet or biomass sorghum for energy and bio-based product production. However, a sorghum expert who had attempted to mine those data reported inconsistent documentation of production of sweet or

[50] DOI, 2015, Order D15PX00044, page 18 of 35.

biomass sorghum by FSA.[51] Furthermore, the FSA data do not generally include data on the purpose for which the crop was grown. Consequently, even if data on sweet sorghum were available, it would be impossible to distinguish between the portion of the crop grown as a feedstock for energy of bio-based products and the portions grown for processing as a food or as a feed.

NASS does systematically collect data on grain sorghum as part of the Census of Agriculture. Prior to 2007, USDA considered sweet sorghum to be a non-grain sorghum. There are occasional records in the Census of Agriculture concerning sweet sorghum production prior to that date. The reader should note that this sweet sorghum reported in the Census was grown for production of food rather than as a bio-based product or energy feedstock. In 2007, the USDA Grain Inspection, Packers and Stockyards Administration published a final rule in the Federal Register that incorporated sweet sorghum with the potential to produce typical sorghum seeds into the definition grain sorghum.[52] Thereafter, NASS documentation of sweet sorghum production is limited. The Contractor believes some sweet sorghum data may be included in the published grain sorghum data series, but there is no way to separate the sweet sorghum data from the aggregate data series.

The Census of Agriculture is the leading source of quantitative data about U.S. agriculture. The Census is conducted every five years. NASS reports the Census "is the only source of uniform, comprehensive agricultural data for every state and county in the United States." Every farmer, regardless of the size or type of operation, is expected to participate in the Census. While the 2012 Census of Agriculture collected information concerning all areas of farming operations, including production expenses, market value of products, and operator characteristics, there is no mention of sweet sorghum grown for any purpose or of biomass sorghum in the 2012 Census reports. No consistent time-series data for sweet or biomass sorghum for energy and bio-based product production are available from this service.

NIFA reports covering sweet and biomass sorghum focus on government grants supporting research into these crops and programs providing incentives for processors to develop processing facilities. The Contractor identified no NIFA publications that included any data series for sweet or biomass sorghum for energy and bio-based product production.

There are numerous public reports from extension offices concerning the potential for production of sorghum as an "alternative crop." These reports include evidence of production potential. In general, the reports address the remarkable range of yields that may be obtained depending on variety, locale, and environmental condition. For example, the University of Florida (UF) Institute of Food and Agricultural Sciences (IFAS) reports:

> *UF/IFAS data are similar to data collected from multiple sources, with a wide range of genetic variability, production practices, and growing environments. These studies have shown that biomass yields of sweet sorghums can range from 8 to 48 tons per acre and juice content ranges from 65% to 80%. The combined*

[51] John Duff, Renewables Director, Sorghum Checkoff, personal communication, March 2015.
[52] Federal Register, 2007, Vol. 72, No. 139: page 39730 / Friday, July 20, 2007 / Rules and Regulations, http://www.gipsa.usda.gov/federalregister/fr07/7-20-07a.pdf, accessed March 2015.

> *sugar content of the juice varies between 9%–20%. Sugar yields vary from 1.6 to 6.9 tons per acre. The bagasse and leaves make up the remainder of the wet biomass. The bagasse represents approximately two thirds of the dry matter. Fermentation of the sugar in the juice yields between 400–600 gallons of ethanol per acre.*[53]

These quantitative studies are generally based on small plot field trials conducted with a wide range of varieties over relatively short periods. The focus of the local field trials is to identify appropriate varieties to plant in the area. Longer time series trials are rare. The largest fields planted have generally been reported to be in the tens of acres. The Contractor requested data from universities, producers, and processors who indicated their involvement in field trials. One has indicated his willingness to provide such data. It was not received in time to be incorporated into this report. A second provided information that his operation has sweet sorghum production data for two "seasons" (2010-2011) in one county in Tennessee and for three "seasons" (2011-2014) in a second county in Tennessee. The total acreage planted for these data ranges from 50 to 165 acres per year. This producer indicated his willingness to provide the entire dataset for the non-hybrid types of sweet sorghum he produces but he is constrained by confidentiality agreements in providing any data associated with the hybrid types of sweet sorghum. Processors consider their data proprietary. It is likely university staff will be willing to release field trial data for a development effort. However, the restricted scope of those data will limit their utility in an actuarial analysis of the crops.

Once processors are fully engaged in commercial production, they are likely to maintain data relevant to the insurance development effort. Several processors have expressed a strong interest in having insurance available for producers providing feedstock for their operation. It is likely that as processing expands data from some processors will become available. While sales under contract are more likely to have third party weight measurements and financial settlement, the Contractor identified no sources documenting such contract sales.

Much of the sweet sorghum produced in the United States is grown for food rather than as an energy or bio-based product feedstock. Anecdotal reports suggest that much of the sweet sorghum grown for food is milled (i.e., processed) on the farm. Production records for these crops processed on the farm are less consistently documented.

Quality

The Contractor could not identify any time series database that documents the percentage of the sweet sorghum harvested at various °Brix levels, nor databases documenting the associated sugar extraction for commercial production. Some data is available from the various biofuel refinery proof-of concept trials on a small scale. The Contractor identified no publicly available data describing the percentage of biomass sorghum harvested at various levels of moisture content or associated financial losses due to additional energy inputs necessary to reduce moisture during processing.

[53] Vermerris, W., J. Erickson, D. Wright, Y. Newman, and C. Rainbolt, 2011, Production of Biofuel Crops in Florida: Sweet Sorghum, http://edis.ifas.ufl.edu/ag298, accessed March 2015.

Production of biomass sorghum and sweet sorghum is measured in U.S. short tons, *i.e.*, 2,000 pounds avoirdupois. The Contractor requested production data from individual producers, processors, and organizations partnering with university extension offices conducting field trials. Very limited data has been obtained as a result of these requests. The field trials are conducted under management practices that may differ from commercial production practices. However, at this time, the field trial and proof-of-concept data appear to be the only data that could be used to document sweet and biomass sorghum production for feedstocks for energy and bio-based products.

VI. STAKEHOLDER INPUT

The Contractor contacted producers, insurance providers, and industry leaders representing producers at the state and national levels to determine the level of interest in an insurance program for biomass sorghum and/or sweet sorghum for energy and biobased product feedstocks. These efforts culminated in listening sessions in California, Florida, Kansas, and Louisiana. The sessions were attended by two producers, one producer organization representative, three insurance industry representatives, and three bio-based products industry representatives. The Contractor also engaged in email correspondence and/or telephone conversations with an additional 43 stakeholders including 15 university extension officers.

The strongest interest in crop insurance for biomass and sweet sorghum as a feedstock for renewable biofuel, renewable electricity, or bio-based products came from the end users of the crop. These stakeholders believed having a dependable supply of sorghum as a feedstock was strongly impacted by the availability of crop insurance for the producers of that feedstock sorghum. In contrast, many of the producers who communicated with the Contractor seemed to consider the sorghum as a catch crop. Based on testimony from stakeholders, the limited demand for biomass sorghum and sweet sorghum, and especially for these crops as a feedstock for energy and bio-based products, was influenced by a decrease in federal support for production of biofuels and a drastic decline in the price of petroleum.

The Contractor gathered stakeholder input during listening sessions with producers, insurance industry representatives, extension agents, producer organization representatives, and USDA staff. The Contractor collected this input during four sessions focused on gathering information regarding the level of interest the sorghum industry may have in acquiring an insurance product for biomass sorghum and sweet sorghum. The sessions were conversations with the stakeholders driven by an agenda (Appendix E). The listening sessions were held in Garden City, Kansas, on March 10, 2015; in Fort Pierce, Florida, on March 12, 2015; in Modesto, California, on March 17, 2015; and in Mansura, Louisiana, on March 19, 2015.

The Contractor contacted four grower associations – National Sorghum Producers, Sweet Sorghum Association, Louisiana Soybean and Grain Research Promotion Board, and Kansas Grain Sorghum – through telephone and email correspondence. The Contractor asked each grower group to convey an invitation to the listening session to its membership. Two weeks before the onsite listening sessions the Contractor sent the USDA RMA-approved Press Release (Appendix F) to local papers and regional agricultural publications. These announcements were available to run for two weeks in each region and contained a brief synopsis of the topic for the listening session as well as an email address to communicate directly with the Contractor. The Contractor did receive email confirmation from one source that the press release had been published on both its website and in its publication for the two week time period prior to the listening session in California. The Contractor also fielded a phone call from a producer/crop insurance agent in Kansas who indicated he read about the listening session in a regional agricultural publication. Additionally, the Contractor contacted university extension specialists in all four targeted states and requested both their presence at the listening sessions and that they convey the information to sorghum producers with whom they worked directly. The Contractor further contacted crop insurance agents in the regions where the listening sessions were scheduled and encouraged their participation and communication of information about the

listening session to their clients. The Contractor also contacted stakeholders from USDA ARC and USDA ERRC. The Contractor contacted six biofuel production facilities in three of the four states which indicated they used sorghum or bagasse as a feedstock for their production process and extended personal invitations to the staff member responsible for acquiring the feedstock for the plants. Finally, the Contractor invited venture capitalist investor groups who report interest in pursuing development of cellulosic bio-refineries or bio-refineries using sweet sorghum as a feedstock.

This comprehensive approach to provide notice to the stakeholder community has generally been successful in encouraging stakeholder participation at listening sessions. As an interesting note, the state in which the bio-refinery involved in using sorghum as a feedstock closed its operations in December 2014 had the largest number of participants at the onsite listening sessions. However, in spite of the large number of invitations extended and the wide range of approaches to reach out to stakeholders, overall participation in the listening session for this research project was low.

To supplement the input gathered from listening sessions, the Contractor conducted several telephonic conversations outside these more structured stakeholder input gathering exercises. Many of the conversations outside the listening session venues were follow-up conversations with leads provided at a listening session. However, one conversation with a major sweet sorghum producer from Missouri was instigated by the producer after hearing about the listening sessions from a colleague. This producer conversation provided useful input which shaped both the agenda and preparation for the formal listening sessions.

Those who participated in the listening sessions were provided a brief summary of the crop insurance development process. Participants were encouraged to express their opinions concerning the feasibility of insuring "biomass sorghum and sweet sorghum that is grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products." Although scheduled for an hour, the Contractor placed no limit on the actual length of the listening sessions and the longest, in Marksville, Louisiana, lasted more than two hours. That session was especially spirited and informative.

Garden City, Kansas

Garden City, Kansas was selected as the site for one of the listening sessions in part because the city is home to the Bonanza Energy Biofuel refinery which boasts a 55 million gallon per year production of biofuel using corn and sorghum as the feedstock. There are also two other biofuel refineries near Garden City. These are located in Hugoton and Colwich, both in Kansas. Both these refineries indicate they use corn and sorghum as feedstock and the refinery in Hugoton reports they use crop residue and cellulosic energy crops as feedstock.

Additionally, Finney County, Kansas, where Garden City is located, boasts production of grain sorghum on more than 95,300 acres[54] and insured acres for grain sorghum in Finney County in 2014 reached 84,125 net acres.[55] The Contractor was provided with a meeting room in the

[54] USDA, NASS, 2014 production, Quick Stats, accessed March 2015
[55] USDA, RMA, 2014 Summary of Business, accessed March 2015

Hampton Inn and Suites in Garden City, and signage was posted in both the lobby of the hotel and near the entrances to the meeting room to encourage participation. The listening session was intended to collect feedback rather than to provide current industry information. The Contractor facilitated the one-hour session with one stakeholder in attendance, a representative from the Topeka Regional Office of RMA.

Fort Pierce, Florida

Fort Pierce, Florida is located about mid-way between the Ineos New Plant BioEnergy refinery in Vero Beach, Florida and 500,000 acres of sugar cane production area on the shores of Okeechobee Lake. The cane acreage has been proposed as a location for sorghum production during the off-can years in the crop rotation. The meeting was held in a meeting room at the Fort Pierce Hampton Inn and Suites in Fort Pierce, Florida from 9:00 am to 10:00 am Eastern time on March 12, 2015. One stakeholder attended this session. The stakeholder was a representative from the bioenergy industry as well as a producer and member of the Sweet Sorghum Association.

Modesto, California

The session in Modesto was located between two ethanol refineries on Highway 99 in California. The Aemetis refinery in Keyes, California reports producing 55 million gallons per year of ethanol using corn and sorghum as feedstocks. The Pacific Ethanol refinery in Stockton, Calfornia reports production of 60 million gallons per year of ethanol, also using corn and sorghum feedstock. Pacific Ethanol also has a refinery in Madera, California, a bit further south of Modesto, which reports production of 40 million gallons per year of ethanol using corn and sorghum feedstock. Furthermore, Stanislaus County sits between Tulare County and Glenn County where the majority of sorghum is produced in California.

The Contractor conducted a listening session at the Stanislaus County Harvest Hall in Modesto, California from 2:00 pm to 3:00 pm Pacific time on March 17, 2015. One stakeholder attended this session. The stakeholder was a representative from the Davis Regional Office for RMA.

Marksville, Louisiana

Marksville, Louisiana is located in the heart of the sorghum production area in Louisiana and at the northern end of the sugarcane production area for the state. Sweet sorghum is produced on relatively small, individual plots by hobby farmers in the area for use in syrup production. The bio-refinery in Jennings, Louisiana shut down operations in mid-December 2014. Prior to ending operations, BP Biofuels North America used sugarcane bagasse as the feedstock to produce 1.5 million gallons per year of ethanol. Sugarcane bagasse and sorghum bagasse have similar physical and chemical characteristics and have been reported as fungible for most biorefining purposes.

The Contractor conducted a listening session at the Hampton Inn and Suites in Marksville, Louisiana from 9:00 am to 10:00 am Central time on March 19, 2015. Four stakeholders attended this session. The stakeholders represented producers, the bioenergy industry, the National Sorghum Producers Association, the Sweet Sorghum Association, and the government.

Listening Sessions Comments

The following comments gleaned from the listening sessions are categorized by theme. The Contractor identifies the origin of the comment by industry segment using the following descriptors:

A = Association Representative
P = Producer
G = Government Agency Representative
E = Bioenergy Industry

Theme 1: Size of Industry

- Sorghum is grown where sugarcane can be grown but also a lot of other locations. (G)
- Biomass and sweet sorghum for energy and bio-based products is still in its infancy. (A)
- It may be premature to have a crop insurance program for sorghum grown as a bio-based product feedstock. (E)
- Sorghum for energy and bio-based products is a logical crop for Tennessee, Kentucky, Missouri, Arkansas, and Mississippi. (P)
- Sorghum is acclimated to grow in much of the contiguous United States. (P)
- Sweet sorghum has a strong potential as a feedstock for specialty sweeteners. This could support hundreds of thousands of acres of production. (P)
- A lot of people have just switched to corn - grain sorghum as a primary crop has just gone down over the years. Though the sorghum industry wants to be up there, when corn prices spike, it is much easier to market corn because producers want to grow it and understand the financial implications of the two options. (G)
- For our refinery, we need between 3,000 and 3,500 tons of feedstock per day to stay operational. That works out to needing about 200 acres [of sorghum or similar feedstock] per day being harvested within about 20 to 25 miles of our facility. (E)
- It's basically a crop that is in an industry that is in its infancy. (E)

Theme 2: Commodity Pricing

- Sorghum can be successfully used at a feedstock for biofuels if the sugar is priced at $0.10 to $0.14 per pound as long as there are federal subsidies supporting the processors. (P)
- Sorghum can be successfully used at a feedstock for bio-based products if the sugar is priced at $0.20 per pound. (P)
- I average 16 tons per acre which generally results in 200 gallons of 80 °Brix expressed liquid. So depending on the price of sugar on the market, I have several options for my production [including providing feedstock to bio-refineries]. (P)

Theme 3: Contract Terms

- Our contracts have a take or pay clause. (E)
- I could see, from this side of it, if on a contracted basis, and if you are looking for a crop that is somewhat consistent in yields, is drought resistant, and uses less water….if you can consistently get that…it would be to their advantage to plant sorghum. (G)
- If they can guarantee a price, and yields are somewhat stable, it would be appealing to a producer given that [dryland yield] is more than other products that they could grow, even with their price risk. (G)

- Even with the other variables that they might be running into - marginal issues. If they had a guaranteed income for the next five years, that's pretty appealing. Even if the price of corn goes up a couple bucks a bushel this year, you never know if it will be this year. (G)
- When I contract for more acreage for my mill, I generally write the contract on a dollar per ton at the silage sorghum market price plus a negotiated premium. (P)
- We are planning to contract for a base rate per ton plus a bonus based on °Brix of sugar in the crop. (E)
- We don't need sorghum sugar for the manufacture of sorghum-based bio-based products. (E)

Theme 4: Type of Insurance Interests

- Sorghum bagasse has the potential to be an important income element for producers. (P)
- When the grain sorghum producers contacted us asking about inclusion in the LEMA [Local Enhanced Management Area], we looked into including them in our expanded written agreement options for limited irrigation. Since the limit is currently 11 inches and they need 11 inches to grow the crop, we don't see including them in our program at this point. (G)
- I haven't heard of any demand for a sorghum bioenergy or biobased products policy. (G)
- I think sweet sorghum would be better served if you could lump it together with its cousins so to say, as an extension of grain sorghum. (E)
- We would look to take advantage of the crop insurance though, only because I think it would prudent and I don't want to find out the hard way how devastating a loss of a sweet sorghum crop could be. (P)
- There are considerations here in Florida that aren't as big a concern in South Texas or New Mexico or Imperial Valley in California...but hurricanes are one. I don't know if insurance would cover disease. (P)

Theme 5: Demand from Biofuels Industry for Crop

- We have invested heavily in research and development using sorghum as a feedstock for bio-based products production. (E)
- The timing of the development of bio-based products technology and sorghum breeding make this a perfect time to develop a sorghum bioenergy/bio-based products agricultural sector. (E)
- We have formally announced our interest in sorghum for bio-based products. (E)
- There is a lot of investment and commercial interest in sorghum for energy and bio-based products. (A)
- There is a potential market for sorghum for energy and bio-based products right now, perhaps more even than actual production. (A)
- There has been a lot of research by seed companies to develop seed for sorghum for energy and biobased products. (A)
- There are many opportunities for sorghum for energy and/or bio-based products. (P)
- Sorghum can be used as a feedstock for butadiene, butanol, ethanol glycol, isobutanol, isoprene, succinic acid, and 1,3-propanediol. (P)

- A single 40 million gallon per year sorghum bioethanol plant would require 125,000 acres of sweet sorghum per year. (P)
- A production scale bio-based products plant would require 187,500 acres of sweet sorghum per year. (P)
- The industry is not getting enough money, not enough interest… everything went to corn…what they have done with corn and soybeans they could probably do with other crops, but with 34% of corn production going to fuel, there is too much incentive. (G)
- If you change that incentive to another product, you will find it - Monsanto and everyone else will fix the seed and hybrid issues to the best of their abilities. (G)
- I believe that within ten years after we open our plant, there will be at least a dozen or more imitators on board. (E)

Theme 6: Natural Risks and Industry Response

- Sorghum is acclimated to grow in the contiguous United States were there is sufficient water available. (E)
- Sorghum is grown where sugarcane can be grown but also a lot of other locations. (G)
- Sorghum for energy and bio-based products is great because it doesn't require irrigation. (A)
- I think sweet sorghum can be grown anywhere in the Sunbelt along the Gulf Coast area, South Texas, certainly Louisiana with its wealth of sugar cane, Southern New Mexico and Arizona and into the Imperial Valley of California…that's where I envision this industry popping up, as well as in Central and South America. (E)
- Unlike the cane industry... they have to replant with a 5 foot section of the cane – if wind lays their crop down horizontally, they would lose the entire crop because it takes a year to replant and mature. In our case, we could be back in business in 90-120 days, so our downtime following a wind event wouldn't be as devastating as it is to the sugar industry. (P)

Theme 7: Risks Associated with Crop and Risk Mitigation Options

- One upside of sorghum as a bio-based products feedstock is its wide harvest window. (E)
- Because of moisture, sorghum as a bioenergy feedstock is more expensive to move than stover or woody biomass. (E)
- Sorghum can be processed after frost. There is little risk at the harvest end of production. (P)
- Sorghum uses less water than corn, to get a decent yield. My experience indicates about 33% less. (G)
- If sorghum is using 40% less water than corn, I would say it is an extremely viable alternative crop solution-given price. (G)
- Just like a sugar mill, whatever you harvest that day has to be processed that day- unlike the corn industry where you stockpile it and nothing happens to it. (E)
- You have to harvest it every day. It is the exact same model of the sugar industry. You have to really harvest it within 24 hours. (E)
- It has to be brought to the mill and processed through the mill in 24 hours. (E)

Theme 8: Financial Risks Associated with Crop and Mitigation Options

- It just doesn't make financial sense to produce cellulosic ethanol from sorghum at this time. (P)
- It doesn't make financial sense to produce cellulosic ethanol from any feedstock at this time. (E)
- There is lots of room for innovation on bio-based products derived from sorghum. (E)
- Sorghum makes more sense for biodiesel than for cellulosic ethanol. (P)
- Production of sorghum for energy and bio-based products will be focused around mills and processing facilities. (A)
- Sorghum biofuels production is best suited to the sugarcane production region. (P)
- Sorghum bio-based products would drive significant acreage increases for sorghum. (P)
- High performance hybrid sweet sorghum will improve financials for bio-based product production and for the farms producing the sorghum. (P)
- Grain Sorghum is very level and might be drought tolerant, but if there is more money to be made in corn, it doesn't make sense to plant sorghum. (G)
- There has been a lot more technology made for corn seed than milo seed. That becomes an issue too- if you can't raise the yields, and corn is creeping up with higher yields every year and milo is the same, you are losing ground. That revenue difference becomes bigger and bigger. (G)
- So at the depressed prices today that ethanol is at, every ethanol supplier is looking for incremental opportunities whether it's drinking alcohol or industrial uses in the chemical industry, the paint industry...your plastic water bottle is a derivative of an oil based product and can be produced using alcohol from sweet sorghum. (E)

VII. RISK ANALYSIS

The Contractor found no evidence the risks associated with production of biomass sorghum and sweet sorghum that is grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products are substantially different from those for grain and silage sorghum, except that the conditions required for pollination and grain development are not crucial for sweet and biomass feedstock sorghum production. Generally, sources of risk in agriculture include production, price (market), financial, institutional, and human (personal) risk. However, the fundamental question addressed in this report is whether it is feasible to provide federally-subsidized crop insurance under the terms of the Act as an element sorghum producer's risk management tool portfolio. In this regard, production risk is the most important factor. While some insurance offered under the Act also protects against market risk, the nature of a specialty feedstock crop makes it impractical to provide price risk protection. The markets are too shallow and because of the impact of transportation costs, production from one area is not fungible with production from another area. In this regard, feedstock crops are substantially the same as silage from corn or sorghum, haylage, green chop, and similar crops with high bulk to value ratios.

Production Risk

Production risk can be systemic or idiosyncratic. Systemic risks, such as wide temperature excursions, affect all operations in a region. Other elements of production risk for commodity crop production (and consequently for production of feedstock crops for bio-products) are idiosyncratic, affecting individual growers. Examples of idiosyncratic production risk include an isolated disease outbreak, localized predation, or lodging of a crop at a particular production location.

Weather-related production risk in production agriculture is caused by events such as high and low temperatures, excess precipitation, lack of precipitation, and wind either singly or in combination. Weather affects the production of a relatively large number of individual producers every year.

Crop diseases are caused by bacteria, fungi, protozoa, and viruses that result in chronic disease losses and catastrophic diseases. Chronic diseases slowly erode production and consequently affect profits. Catastrophic losses can lead to the ruin of entire industry sectors. Decreased resistance to disease may result from physical stress characterizing high density mono-culture. Consequently, good management practices are essential to limiting disease in agricultural crops, and producers typically use appropriate practices to manage these risks.

Sorghum producers plant at high population densities to maximize yields. While major seed companies (e.g., Pioneer, DeKalb, *etc*.) offer proprietary lines, there are numerous small companies offering heritage seed lines and recently selected varieties. Seed developed for a specific locale may increase yield potential.

Soil temperature at planting is critical. The seed generally requires soil temperatures of at least 60°F (15.5°C) for good germination and emergence. Like corn and sugar cane (other grasses), sorghum photosynthesizes using the C4 pathway. Consequently, daytime temperatures of 90°F

(32°C) or more help to maximize photosynthesis. Conversely, low daytime temperatures can limit sorghum production.

In contrast to many crop plants, short periods of drought do not limit pollination or fertilization of sorghum. This likely reflects the less highly selected varietal characteristics of commercial sorghum seed. Furthermore, sorghum leaves and stems are particularly adept at limiting losses to transpiration when sufficient moisture is not available. Consequently even relatively long periods of drought do not limit photosynthesis, although production may be limited. Furthermore, sorghum is more tolerant of wet soils and flooding than most grain crops. Since sweet and biomass sorghum do not require flowering, pollination, fertilization, and grain development for a successful harvest, the crops are less prone to production risk than grain sorghum.

Techniques for control of weeds, insects and disease are well documented. Seed can be treated for the control of seed rot and blights affecting seedling. Leaf diseases can limit productivity in areas with high rainfall and humidity, but generally do not cause serious losses. Planting disease-free seed and disease resistant hybrids, rotating with other crops, providing optimum mineral nutrients, and removing infested debris all help to minimize losses from disease.

Sorghum is generally resistant to damage from most pests. Corn earworms (*Helicoverpa zea*), greenbugs (*Schizaphis graminum)* and some of the aphid species (family Aphididae) require management. Pesticides are generally adequate so infestations do not limit production. Wildlife is a potential source of loss, with birds preying on seed and wild pigs causing lodging. Since seed production is not a focus of bioenergy/bio-products sorghum production, in general sweet and biomass sorghum varieties have lower risk from wildlife losses than most cultivated plants.

Insurable biomass sorghum and sweet sorghum production risks should include adverse weather, disease and insect damage if control mechanisms either are not available or fail, earthquake, wildlife damage, wildfire, volcano, and failure of irrigation supply if caused by any of the above named causes of loss. These are precisely the risks that affect production of the grain sorghum crop. Risks resulting from human actions (e.g., fires caused by human activities, pollution, agricultural chemical spills, etc.) are not insurable perils under the Act.

There are no acts of nature beyond the control of the producer that uniquely impact biomass sorghum and/or sweet sorghum production or value during the production stage. Both sweet and biomass sorghum are warm-season crops that tolerate drought and high temperatures better than many crops but neither grow well under low temperatures. Optimal soil temperature for planting these crops is higher than for many crops. One redeeming factor which helps offset the warm soil requirements for planting is both crops mature more rapidly when planted later in the season. Even so, producers need to be careful to give the crop adequate time to mature prior to the first expected killing frost in the region (Appendix G).[56]

[56] University of Florida, IFAS Extension, Wilfred Vermerris, John Erickson, David Weight, Yoana Newman, and Curtis Rainbolt, "Production of Biofuel Crops in Florida: Sweet Sorghum", December 2011, http://edis.ifas.ufl.edu/ag298, accessed March 2015.

Relative to drought peril, "Sorghum grown in shallow soils or soils very low in organic matter may be more prone to drought stress. Although sorghum is more tolerant of drought stress than many other crops, ample moisture during the growing season is important for good yields of stalks and juice."[57] Every source with whom the Contractor discussed production perils of sorghum indicated the crop was drought resistant. Some claimed the crop was able to produce with 60 percent of the water necessary to produce a corn crop in the same soil.

The insurable or uninsurable perils for sweet and biomass sorghum grown as bio-based products feedstocks will not be substantively different from the risks associated with other field crops. The most significant perils that can affect sweet and biomass sorghum grown as bio-based products feedstocks that do not affect grain and silage sorghum are harvest and postharvest perils associated with the baling and storage of the crops. These are uninsurable perils. The first case reflects management practices whose differential outcome is not an insurable risk. In the second case, any losses are post-harvest risks that are uninsurable under the terms of Section 1508(a)(2) of the Crop Insurance Act. In the absence of data specifically addressing production of energy and bio-based product feedstock sorghum, the most effective method to estimate the frequency and severity of the important risks for these special types of sorghum will be to use expert opinion to establish factors relating the risks of the specialty types to the risks of sorghum types already insured.

Price Risk

The prices of most crops are subject to market forces. Inputs for production agriculture, including fertilizers, fuel, and chemicals (e.g., pesticides), are often substantial. Substantial increases in input costs substantially affect the producer's margins and thus the producer's net revenues. To date, input price risks have not been insured under FCIC insurance programs, except to the extent they are an element of the WFRP calculations. It is anticipated that any biomass sorghum and sweet sorghum insurance program would be based on yield risk and that insurance prices would be fixed at either contract price levels or at a price election based on available data (using grain sorghum as a proxy) prior to the sales closing date.

The primary economic risk faced by producers of biomass sorghum and sweet sorghum are rooted in the fossil fuel commodity markets. When fossil fuel prices are high, biomass sorghum and sweet sorghum production for use as a biofuel feedstock is in demand and premium contracts are provided by biofuel refineries. When fossil fuel commodity prices are low, biofuel refineries scale back production and look for alternative feedstocks to continue production.

Producers of sweet sorghum have some recourse to mitigate movements within the fossil fuel commodity markets in that there are several alternative markets for sweet sorghum production: e.g., granulated sugar; sweet syrup; and silage. Conversion of sweet sorghum syrup into granulated "table" sugar is possible and some producers who spoke with the Contractor have entered into cooperative efforts with USDA ARS to develop a process to accomplish this on an industrial scale. Some sweet sorghum production studies indicate the current processes for granulating sweet sorghum syrup can yield 100 kg of sugar for every ton of 16 °Brix sweet sorghum harvested. The Contractor found evidence of local markets wherein consumers can

[57] *Ibid.*

purchase sorghum syrup for use in cooking and local cuisine. Some producers indicated they have been able to sell some of their sorghum syrup to "flavor houses" which then use the syrup in various flavor creation processes. Finally, several producers indicated they use the bagasse remaining after sap extraction as feed silage for livestock. Due to its bulk and low value, the bagasse must be used locally if fed to livestock. The size of such alternative markets is unknown.

A secondary economic risk faced by producers of biomass sorghum and sweet sorghum stems from legislative action taken at both the federal and state governmental levels. The ethanol mandate is a prime example of legislative action impacting planting decisions of producers. Producers make decisions to plant a crop primarily based on the anticipated return on investment. When the Federal Government decided to encourage production of ethanol by providing subsidies for development of refining facilities and for ethanol production, it substantially affected the market for the refinery feedstocks (primarily corn). Thus when a biofuel refinery offers a producer a contract to grow biomass sorghum, the producer will consider the opportunity for maximizing return on investment between competing crops and the premium offered by the contract. The primary difference in these two scenarios is the origin of the incentives.

Quality deficiencies that affect the value of sweet sorghum include: 1) the °Brix percentage for sugar content is lower than 16 (reported average °Brix for harvested sweet sorghum); and 2) loss of value due to degradation after harvest. The first factor could be attributed to adverse natural conditions beyond the control of the producer but would require appropriate loss adjustment procedures to ensure management practices did not contribute to the reduction in stored sugars. The second would not be insurable as it would reflect poor management for the intended market.

Processors did not identify specific quality standard for sweet sorghum for which they contract. Anecdotal evidence indicates heavy, wet biomass is less desirable as a feedstock and more time consuming to work into the cellulosic ethanol production process.

In spite of substantial efforts, the Contractor was unable to identify any time series data collected by a consistent methodology to quantify economic risks to producers of sorghum grown for energy or as a feedstock for bio-based products. In the absence of price series data, it is not possible to assess the specific price risks associated with biomass and sweet sorghum as a crop.

Financial Risk

An agricultural producer's primary source of financial risk stems from capital and labor investment. Transportation costs associated with moving biomass sorghum or sweet sorghum to a processing facility is an additional financial risk potentially borne by the producer. Another financial risk is the potential need to borrow funds to manage cash flow. Although producers often comment about the relationship between crop insurance and access to operating loans, it is important to note financial risk is not an insurable risk under the Act. However, banking regulations often require collateral for a loan. A crop insurance policy may be accepted by many lenders as adequate collateral. Also, fluctuations in transportation costs which are incurred after harvest are not an insurable risk under the Act.

Institutional Risk
Any regulatory action that interferes with the normal course of business has the potential to cause loss of revenues and markets. However, such risks are not insurable under the Act.

Human or Personal Risk
Production agricultural operations must manage human risk in compliance with the Occupational Safety and Health Act (OSHA) and the Fair Labor Standards Act (FLSA). Potential risks to personnel include cuts and abrasions, infection (e.g., tetanus infections), mechanical injury from equipment, hearing loss due to excessive noise, and death. In addition, key personnel may retire, die, or divorce, with effects on the operational structure or activities. These risks fall outside the purview of Federal crop insurance. Human and personal risks are not insurable risks under the Act.

Loss Control Techniques
Biomass sorghum is primarily produced to be used as a feedstock for bio-based product development. Sweet sorghum is primarily produced to obtain the sugars present in the juice extracted from the stalk of the plant through expression. These sugars are used for various purposes, though this report specifically focuses on the bio-product purposes for which these sugars are expressed. Once the sugars are expressed, the remainder of the plant, known as "bagasse", "can be burned to run the factory or cogenerate electricity, or used as feedstock for cellulosic ethanol."[58] To maximize sugar extraction from the sweet sorghum plant producers need to minimize loss of sugars during storage.

The harvest process impacts the loss of sugars prior to processing into bio-products. University extension studies have shown producers who "forage chop" sweet sorghum must process the crop for sugar extraction within 24 to 48 hours. When sweet sorghum is forage chopped at harvest, the sugars in the plant tissues immediately begin to break down. After approximately 48 hours this degradation has resulted in a net zero amount of glucose remaining. At this point, the forage chopped sweet sorghum is useful only as bagasse in the bio-refinement process. Other harvesting options available for sweet sorghum producers which have been studied are whole stalk and billet cut (cut into short stalk sections). In both of these approaches, the timeline for storage before unacceptable losses of sugar in the plant juice occur is extended from several days to up to two weeks, depending on environmental conditions and the amount of moisture in the harvested crop. The loss of sugars begins immediately upon harvest, but the rate at which the deterioration occurs is slowed by billet and stalk cutting, enabling a processing facility to store the crop prior to processing without loss of significant amounts of sugar. [59]

Regardless of the harvest approach, the timeline for processing sweet sorghum is relatively short in comparison to other insured crops where the storage of the crop may be as long as a year before significant deterioration impacts the value of the crop. Under the best circumstances, the crop may be stored up to two weeks.[60] The method for harvesting the sweet sorghum crop

[58] USDA, ARS, Sarah E. Lingle, "Opportunities and Challenges of Sweet Sorghum as a Feedstock for Biofuel", http://pubs.acs.org/doi/abs/10.1021/bk-2010-1058.ch011, accessed March 2015.
[59] Sarah E. Lingle, Thomas L. Tew, Hrvoje Rukavina, Deborah L. Boykin, "Post-harvest Changes in Sweet Sorghum I: Brix and Sugars", http://link.springer.com/article/10.1007/s12155-011-9164-0, accessed March 2015.
[60] This timeline is dependent on additional variables such as ambient storage temperature, water retention of stalks, etc…

greatly impacts this timeline and the potential value of the crop as a bio-product feedstock. However, the losses of value associated with these changes are uninsurable.

VIII. FEASIBILITY ASSESSMENT

The SOW for this effort specifically states: "RMA is not looking for a complete feasibility study, but is looking for specific aspects needed to understand and determine what type of crop insurance program will work best for these crops, producers, and for the specific data needed to create a crop insurance program that covers producers with an optimal program." However, the SOW also requests the Contractor to "…specify what type of insurance coverage, if any, would best meet [the insured's] needs" and "… recommend the type and extent of crop insurance protection."[61]

After careful consideration of all the feasibility standards to support development of a new crop insurance product, the Contractor has concluded it is not feasible to develop a traditional crop insurance product built on a foundation of historical production data for biomass sorghum and sweet sorghum grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products.

Producers of feedstock for the bioenergy industry face production risks. Changes in yield per acre result from causes similar to those affecting the yield per acre of field and row crops. However, the variability in production of biomass sorghum and sweet sorghum grown under appropriate management practices appears to be quite a bit lower for biomass sorghum and sweet sorghum than for many other crops. Feedstock sorghum crops do not need to reach full maturity to be harvested as feedstock. Furthermore, for sweet sorghum, there is some evidence that early harvest may increase the sugar content in the stalk, potentially adding value to the crop.

Due to the unique nature of biomass sorghum and sweet sorghum production, the feasibility analysis of a production insurance product for this sector must address not only the literature on agricultural risk, but also stakeholders' perceptions about the perils that concern them. A great many risks in the biomass sorghum and sweet sorghum industry are managed using non-insurance approaches. For example, the vast majority of producers plant fewer than 10 acres of the crop and these crops are often a small fraction of the producer's crop mix. The larger producers, those with 50 acres or more, still view biomass sorghum and sweet sorghum as ancillary crops produced for niche markets or personal use. The producers with whom the Contractor spoke do not appear concerned with risk related to yield.

Additionally, both producers and bioenergy industry representatives expressed limited concern about weather events and to an even lesser extent, disease. Producers seem to be most concerned with domestic market outcomes that affect their revenues.

Section 2.3 of the SOW in the contract requires the Contractor to keep in mind the criteria of feasibility when recommending a possible insurance program. These are addressed sequentially below.

[61] DOI, 2015, Order D15PX00044, page 24 of 35.

Feasibility Requirements

The proposed insurance coverage must conform to RMA's enabling legislation, regulations, and procedures that cannot be changed. If data were available, it would likely be possible to develop insurance under the terms of the Act. However, the Contractor could discover no time series database containing historical production data for either biomass sorghum or sweet sorghum. The Contractor identified no data that could be used to establish an insured crop: proxy crop relationship, although anecdotal testimony suggests grain sorghum and silage sorghum would be appropriate proxy crops.

Producers or their agents must be willing to pay the appropriate price for the insurance. This requirement is not seen as an insurmountable barrier to feasibility, except to the extent that very few producers expressed interest in the insurance. The willingness of producers to pay is influenced by the coverage available and the costs associated with the insurance offer. It is anticipated premiums for an insurance product would be similar to those for silage sorghum. In the 2014 crop year, 504 policies paid premiums to insure silage sorghum on slightly more than 82,000 net acres.[62] This insurance covered over 35 percent of the total acreage planted to silage sorghum in the states where the insurance is offered.[63] Should premiums be considered too high, most producers would likely continue risk management through non-insurance mechanisms.

The insurance product must be effective, meaningful and reflect the actual risks of the producers. This requirement is not seen as an insurmountable barrier to feasibility. It is anticipated that premiums for an insurance product to cover actual risks related to producing biomass sorghum and sweet sorghum would be relatively equivalent to those charged for silage sorghum. Participation rates for biomass sorghum and sweet sorghum producers are anticipated to follow those of the silage sorghum product for those producers with production contracts.

The perils affecting production must be identified and categorized as insurable and non-insurable. This requirement is not seen as an insurmountable barrier to feasibility. The relevant perils are no different than for many other crops managed for grain or sugar production. Evidence that a cause of loss occurred can be found.

Be ratable and operable in an actuarially sound manner. This requirement is currently seen as an insurmountable barrier to feasibility. Sufficient data for a rigorous actuarial analysis of biomass sorghum and sweet sorghum do not exist. There are no public data to allow rating or underwriting of operation-level yield variability. Published regional data for feedstock sorghum are also non-existent. Private data documenting yields is confidential, proprietary, and very limited. The Contractor believes, in the current environment, it is not feasible to collect sufficient production data for traditional insurance development efforts. It does not appear to be possible to collect production data by sample survey. The specific producers who grow these crops are not known; hence, the population is unknown. These specific producers represent a small percentage of the total population of producers. Hence, a sample survey of producers in an area will find that most do not produce the crops of interest. Furthermore, such a survey would

[62] USDA RMA, 2015, Summary of Business by Crop, http://www3.rma.usda.gov/apps/sob/current_week/crop2014.pdf, accessed March 2015.

[63] The planted acreage specific to the counties where silage sorghum is insured is not known.

be limited by the constraints imposed by the Paperwork Reduction Act and thus require a significant amount of time and effort to obtain approvals.

For biomass sorghum and sweet sorghum, there is a challenge in establishing price (and therefore the insurable liability), though this challenge may be overcome by requiring the producer to have a contract which specifies amount of product to be delivered and a method for determining the price for that delivered product to qualify for insurance coverage. Also, it most likely would be possible to derive some relationship to the price of grain sorghum or another commodity (such as sugar) to establish a price. This is the procedure used to determine the projected price for corn silage and silage sorghum. However, price would not be an issue if a contract is required before insurance can attach. The contract price replaces the projected price otherwise developed.

Contain underwriting, rating, pricing, loss measurement, and insurance contract terms and conditions. The contract is a legal document. The terms and conditions needed to establish insurance coverage for the proposed crops are not substantially different from those for other crops. Consequently, this requirement is not seen as an insurmountable barrier to feasibility. Regarding underwriting, most diseases of the feedstock sorghums are controllable and the impact on production manageable, the conditions which substantially impact production from operation to operation or time to time are limited named perils (generally catastrophic weather events) for which commercial insurance is not available. Contract pricing is used in a number of existing RMA products. The Contractor spoke to bioenergy representatives who plan to contract biomass sorghum and/or sweet sorghum as part of their business model. In every case the prices offered were to be based on the spot market supply and demand for either silage sorghum or sugar. No exchange offers futures contracts for biomass sorghum or sweet sorghum. Every representative indicated no knowledge of publically available information regarding contract purchases or cash forward-pricing of biomass sorghum or sweet sorghum. While substantial underwriting efforts would be required to address the contracting attribute of the industry, similar issues have been addressed in other insured crops priced by contract. The most important matter would be determining the maximum contract price allowed by the insurance coverage; however, this would not be an insurmountable obstacle. Language addressing loss measures and insurance terms and conditions should be similar to that language in existing policies.

The Contractor notes that many crops insured by FCIC require a contract for insurance to attach. These crops would not be the first with that restriction. Insuring open market production is not advisable due to the significant lack of viable alternative outlets for the crops. An exception might be made for producers who can prove a history of feeding an adequate number of livestock.

There must be an appropriate geographic distribution of production to ensure a sound financial insurance program. The Contractor understands this requirement to apply to the FCIC portfolio, which is distributed throughout the United States. This requirement is not seen as a barrier to feasibility. However, one geographic barrier to development should be considered. Production must be near a bio-refinery because of transportation costs. Furthermore, until the bioenergy industry contracts for more production of these crops, the pool of potential insureds is extremely limited and participation in any insurance product is seen as

low. Hence, insurance, if offered, can only exist for locations within 25-30 miles of an operating processing facility.

There must be enough interest for the risk to be spread over an acceptable pool of insureds. The Contractor understands this requirement also applies to the FCIC portfolio. Hence, this requirement is not seen as a barrier to feasibility. However, the same limitations described regarding geographic distribution apply to this criterion.

Customers must not be able to select insurance only when conditions are adverse. This requirement is not seen as a barrier to feasibility. Sales closing dates are intentionally set to minimize the potential that insureds might have the opportunity to predict the occurrence of potentially insurable perils of greatest concern (weather perils). Sweet sorghum and biomass sorghum crops are subject to the same perils as sorghum planted for the production of grain. During any development effort, the Contractor will need to consider the potential for multiple sales closing dates for some regions of the United States where multiple planting and harvest periods for sorghum are considered good management practices.

Moral hazards must be avoidable or controllable. This requirement is not seen as an insurmountable barrier to feasibility. Avoiding moral hazard would require substantial underwriting constraints. Although generic appropriate practices can be identified, there are large differences in the management of operations (with some being managed like a livestock forage operation and others being managed like a sugar mill operation). The information asymmetries in these disparate practices would need to be addressed. It is worth noting that some operations which have interest in this insurance are vertically integrated; underwriting rules to address this structure will be important. Many insured crops are produced within vertically integrated organizations. The Contractor believes the underwriting rules in place for these organizations are adequate.

There can be no chance of beneficial gain. This requirement is not seen as an insurmountable barrier to feasibility. Avoiding potential for beneficial gain would also require the underwriting constraints described previously. This criterion can be achieved by setting transitional yields in a conservative manner.

There must be no unacceptable change in market behavior or unacceptable market distortions in terms of either a change in quantity supplied or shift in the supply curve. From the perspective of crop insurance, this requirement is not seen as a barrier to feasibility. The industry is minute and subject to substantial changes from year to year. Market forces shape many operational decisions. While market forces will also influence the purchase of insurance, it is unlikely the introduction of appropriately-rated production insurance would change market behavior in other areas noticeably. Other market forces will continue to dominate the behavior of the markets and render the effects of crop insurance on the markets less significant. A particular challenge in considering the feasibility of biomass sorghum and sweet sorghum insurance is the bioenergy market influences imposed by both the fossil fuel industry and federal legislative actions. This is illustrated by the recent dramatic fall in the price of oil on the international market and the recent legislative movement to remove federally subsidized mandates for corn based ethanol production.

Sufficient data for a rigorous actuarial analysis of biomass sorghum and sweet sorghum do not exist. This is a substantial barrier to the development of a new insurance policy. However, there are FCIC insurance products for both grain sorghum and silage sorghum based on yield. A written agreement under one of these sorghum policies could be offered for producers in areas where sorghum is already insurable. In addition, the WFRP provides potential coverage for losses for feedstock sorghum crops due to natural causes. Insurance under one or both these approaches offers a potential safety net for producers of the sorghum feedstock crops. Such an approach would increase the potential pool of available data for future analyses and would also address the legislative mandate for "policies" to insure feedstock biomass and sweet sorghum.

IX. RECOMMENDATIONS

The Contractor considered a variety of approaches for insurance of sweet and biomass sorghum grown as a feedstock for energy production and bio-based products. These included:

- A new stand-alone Actual Production History (APH) yield-based insurance product developed for the crop;
- A new area insurance product based on the yield of a proxy crop;
- Rainfall based insurance similar to 13-RI-PRF;
- Insurance under the Silage Sorghum Endorsement (11-0059) to the Coarse Grains Provisions (11-0041);
- The Whole Farm Revenue Protection Pilot Policy (15-0076); and
- Insurance under a written agreement to the Coarse Grains Provisions (11-0041).

After careful consideration of all the feasibility criteria for the development of a new crop insurance product, the Contractor has concluded it is not feasible to develop a traditional crop insurance product built on a foundation of historical production data for biomass sorghum and sweet sorghum grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products. The Contractor did not find significant interest in crop insurance for these crops. In the absence of demand for a stand-alone product and of time-series commercial production data for either of these types of sorghum, it is also infeasible to develop a new area insurance product based on the yield of feedstock sorghum or of a proxy crop.

In analyzing the alternatives to a stand-alone product for biomass sorghum and sweet sorghum, the Contractor concluded the most viable approach for providing an insurance program for producers of biomass and sweet sorghum grown as a feedstock for energy production and bio-based products would combine coverage under the WFRP plan where appropriate, with coverage under a written agreement on the yield product for grain sorghum.

Neither the existing rainfall index product nor the vegetation index product (13-RIVI) nor the combination of the two provide coverage in all the states and counties where biomass and sweet sorghum are likely to be grown as a feedstock for energy production and bio-based products. Furthermore, some sorghum production management includes supplemental irrigation. Irrigation renders rainfall and vegetation indices poor proxies for actual production of sweet and biomass sorghum grown as a feedstock for energy and bio-based products. Furthermore, the paucity of time-series production data makes it impossible to conduct appropriate correlation studies between the crop yields and the indices.

The Contractor heard anecdotal reports that some producers of sweet sorghum use the existing silage sorghum insurance product as a risk management tool. Since silage is a biomass-based product and the mass of sweet sorghum produced is one of the two crucial factors affecting the value of the crop (the other being the °Brix), it is not illogical to consider the possibility of insuring sweet sorghum and biomass sorghum under the Silage Sorghum Endorsement. However, the Silage Sorghum Endorsement is available only in selected counties in Colorado, Kansas, New Mexico, Oklahoma, and Texas. The limited availability of the Silage Sorghum Endorsement means the product is not available to producers in major regions where production of biomass and sweet sorghum grown as a feedstock for energy production and bio-based

products is contemplated. The Contractor believes it is not appropriate to expand the program for one sorghum type as a mechanism to insure another type when data for such an expansion are not available. Consequently, under RMA's criteria of feasibility, these approaches for development of insurance for biomass and sweet sorghum grown as a feedstock for energy production and bio-based products are not currently feasible.

However, the two remaining methods for providing a safety net for producers of biomass and sweet sorghum grown as a feedstock for energy production and bio-based products do not require either a substantial population of interested buyers or wide-ranging time series production data. The WFRP policy provides a range of coverage options for all commodities produced on a farm or ranch. This plan provides coverage for up to $8.5 million in insured revenue, including revenue derived from specialty crops.

Unfortunately, the WFRP insurance is not available in every state where production of biomass and sweet sorghum grown as a feedstock for energy production and bio-based products is contemplated. This is why providing a safety net under written agreements on the yield product for grain sorghum is also recommended. Using written agreements does not eliminate the need for a certain amount of developmental activity. The parameters of the insurance offer via the written agreement must be established. However, if a contract is required for insurance to attach, it may be possible to minimize the scope of the development effort. The Contractor believes providing guidance for such written agreements can be accomplished by additions to the Special Provisions available in the Actuarial Information Browser (http://webapp.rma.usda.gov/apps/actuarialinformationbrowser/).

Development of the written agreements special provision language would include at the minimum:

- Identification of the crops, type, and practices insurable under the bio-based products written agreement;
- Pricing procedures including a requirement for a contract for production and specific required elements of that contract;
- The mechanism to establish the guarantee using a producer's historic production experiences and the contract pricing; and
- Underwriting to assure only qualified producers seek a written agreement.
- Due to the similarity in risk profiles for grain sorghum and other sorghum types, the Contractor believes the underlying rates for grain sorghum, though not likely perfect, could be used initially, with a factor to address any differences that are documented as data become available.

During the development phase, the Contractor would also need to address Data Acceptance System requirements, implementation of the grain sorghum rating approach for a bulk (i.e., not grain) product, and the possibility that sweet sorghum grown for sorghum syrup would logically be included in the added written agreement language. While the geography of the offer is an obvious underwriting consideration, the indefinite nature of the location of current and future refineries that may use sweet sorghum and biomass sorghum as a feedstock suggests the written agreement instructions should be more universally offered, while potential slipsheets to the Crop Insurance Handbook (CIH) and Loss Adjustment Manual Standards Handbook (LAM) provide

additional guidance for AIPs and their agents concerning the appropriate management of this offer.

Appendix A

2014 NASS Survey
Grain Sorghum Production by County

Table A1. Arkansas Acreage by County

County	Acres
Arkansas	5,200
Chicot	5,000
Clay	1,500
Crittenden	20,600
Cross	8,600
Desha	3,200
Greene	1,900
Lawrence	1,500
Lee	22,000
Mississippi	3,700
Monroe	8,500
Phillips	35,000
Poinsett	5,100
Saint Francis	17,000
Woodruff	6,600
Other Counties	13,200

Table A2. Colorado Acreage by County

County	Acres
Bent	7,200
Crowley	1,800
Kit Carson	22,300
Yuma	7,400
Other Counties	231,600

Table A3. Illinois Acreage by County

County	Acres
Jefferson	660
Other Counties	8,940

Table A4. Kansas Acreage by County

County	Acres	County	Acres	County	Acres	County	Acres
Allen	1,200	Grant	13,800	Miami	980	Russell	43,500
Barber	8,500	Gray	83,500	Mitchell	45,900	Saline	24,800
Barton	69,700	Greeley	44,500	Morris	7,100	Sedgwick	39,300
Butler	7,400	Hamilton	32,300	Morton	36000	Shawnee	800
Cheyenne	14,000	Harper	14,900	Neosho	2,100	Sherman	15,200
Clark	19,800	Harvey	18,100	Ness	57,800	Smith	66,600
Cloud	42,800	Haskell	47,500	Osage	1,750	Stafford	24,200
Comanche	15,300	Hodgeman	27,900	Osborne	56,100	Sumner	58,800
Cowley	19,200	Jackson	1,000	Ottawa	29,300	Trego	60,000
Crawford	1,850	Jewell	57700	Pawnee	60,800	Washington	28,900
Decatur	15,400	Kearny	60,600	Rawlins	31,100	Wichita	53,600
Dickinson	36,100	Kiowa	18,300	Reno	43,000	Wilson	1,400
Edwards	29,500	Labette	3,800	Republic	23,100	Woodson	2,000
Finney	95,300	Lincoln	39200	Rice	40,700	Other Counties	756,170
Ford	81,400	Marion	21,600	Rooks	56,200		
Franklin	2,150	Mcpherson	33,200	Rush	55,300		

Table A5. Louisana Acreage by Parrish

Parrish	Acres
Avoyelles	25,900
Catahoula	12,800
Concordia	10,600
Morehouse	2,300
Rapides	5,700
Richland	2,600
Saint Landry	12,200
Tensas	6,700
Other counties	14,900

Table A6. Mississippi Acreage by County

County	Acres
Bolivar	5,400
Chickasaw	1,700
Coahoma	8,400
Holmes	1,300
Humphreys	3,800
Panola	11,900
Pontotoc	1,500
Quitman	14,900
Sunflower	7,900
Tallahatchie	4,800
Tunica	11,800
Washington	2,600
Yazoo	5,100
Other Counties	22,900

Table A7. Missouri Acreage by County

County	Acres
Butler	1,700
Callaway	1,600
Dade	900
Dunklin	3,800
Maries	450
Morgan	350
New Madrid	2,000
Newton	350
Pemiscot	3,500
Stoddard	2,900
Other Counties	34,850

Table A8. Nebraska Acreage by County

County	Acres	County	Acres	County	Acres
Dundy	2,700	Hitchcock	11,400	Red willow	17,800
Franklin	3,800	Johnson	500	Seward	3,830
Frontier	9,600	Kearney	500	Thayer	2,950
Gage	3,900	Merrick	2,300	Other Counties	73,020
Hall	2,600	Nuckolls	6,300		
Hayes	3,400	Pawnee	1,800		

Table A9. New Mexico Acreage by County

County	Acres
Other Counties	1,000

Table A10. Oklahoma Acreage by County

County	Acres	County	Acres	County	Acres
Alfalfa	8,200	Garfield	38,500	Oklahoma	1,000
Blaine	3,100	Grant	38,000	Osage	1,800
Caddo	11,500	Kay	19,000	Ottawa	3,600
Canadian	1,200	Kingfisher	1,300	Payne	1,100
Cimarron	30,000	Kiowa	7,800	Roger Mills	1,450
Cotton	3,300	Logan	2,400	Texas	58,000
Craig	1,100	Mayes	1,050	Wagoner	3,100
Custer	6,800	Noble	9,000	Washita	9100
Ellis	3,350	Nowata	700	Other Counties	43,350

Table A11. South Dakota Acreage by County

County	Acres
Lyman	51,000
Tripp	28,800
Other Counties	43,200

Table A12. Texas Acreage by County

County	Acres	County	Acres	County	Acres	County	Acres
Armstrong	19,700	Dawson	21,200	Hutchinson	6,700	Reagan	1,000
Austin	1,400	Delta	8,000	Jackson	9,700	Roberts	2,000
Bailey	24,800	Ellis	17,100	Jim wells	37,200	Robertson	4,600
Bee	24,300	Falls	7,300	Johnson	7,700	Runnels	4,000
Bell	12,100	Fannin	6,300	Kleberg	44,900	San Patricio	97,000
Bexar	3,800	Fayette	500	Lamar	9,800	Starr	29,500
Brazoria	19,900	Floyd	56,800	Lamb	41,000	Swisher	63,900
Briscoe	18,700	Fort bend	27,200	Limestone	2,200	Terry	39,100
Burleson	4,100	Frio	1,700	Live oak	5,800	Tom Green	17,100
Caldwell	3,400	Gillespie	500	Lubbock	37,100	Travis	7,000
Calhoun	17,400	Gray	11,100	Lynn	35,300	Uvalde	6,600
Cameron	86,900	Grayson	9,200	Matagorda	31,500	Victoria	16,200
Carson	42,700	Guadalupe	15,300	Medina	5,700	Wharton	30,900
Collin	11,300	Hale	73,300	Milam	7,000	Willacy	101,200
Colorado	1,200	Hamilton	2,600	Moore	39,000	Williamson	11,200
Concho	3,700	Hays	900	Navarro	9,000	Wilson	5,600
Cooke	5,800	Hidalgo	96,200	Nueces	154,600	Zavala	2,400
Coryell	2,700	Hill	20,600	Ochiltree	44,600	Other Counties	421,500
Crosby	14,900	Hockley	35,800	Parmer	50,000		
Dallam	19,100	Hunt	8,000	Randall	19,700		

Appendix B

2012 NASS Census of Agriculture
Grain Sorghum, Silage Sorghum, and Sorghum Syrup
Production Data by County

Table B1. 2012 NASS Census of Agriculture
Grain Sorghum, Silage Sorghum, and Sorghum Syrup Production Data by County

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
ALABAMA							
01003	BALDWIN	685	45,163	64	3,544		
01005	BARBOUR	401	20,816				
01017	CHAMBERS			(D)	(D)		
01019	CHEROKEE	(D)	(D)			(D)	(D)
01031	COFFEE	609	29,160	198	4,950		
01035	CONECUH	(D)	(D)				
01039	COVINGTON	(D)	(D)	(D)	(D)		
01041	CRENSHAW			165	1,320		
01043	CULLMAN	(D)	(D)	(D)	(D)	(D)	(D)
01045	DALE	376	18,245	(D)	(D)		
01047	DALLAS	490	20,708				
01049	DEKALB	(D)	(D)	(D)	(D)	(D)	(D)
01051	ELMORE	(D)	(D)				
01053	ESCAMBIA	(D)	(D)				
01057	FAYETTE			100	5,540		
01061	GENEVA	(D)	26,201	(D)	(D)		
01067	HENRY	1,033	47,571				
01069	HOUSTON	252	11,420				
01073	JEFFERSON	81	1,347				
01075	LAMAR			(D)	(D)		
01077	LAUDERDALE	(D)	(D)				
01079	LAWRENCE			270	9,990		
01081	LEE	64	1,792				
01083	LIMESTONE	(D)	(D)				
01085	LOWNDES	(D)	(D)	560	13,374		
01089	MADISON			(D)	(D)		
01097	MOBILE	(D)	(D)				
01101	MONTGOMERY	450	13,500				
01103	MORGAN	(D)	(D)	(D)	(D)		
01107	PICKENS	108	8,640				
01109	PIKE	144	7,488				
01113	RUSSELL	(D)	(D)				
01117	SHELBY	(D)	(D)				
01119	SUMTER	500	23,000	360	5,250		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
01127	WALKER					(D)	(D)
	ARIZONA						
04003	COCHISE	2,223	312,072	125	2,370		
04009	GRAHAM	740	124,056	(D)	(D)		
04013	MARICOPA	681	(D)	8,069	198,681		
04015	MOHAVE			(D)	(D)		
04019	PIMA	2,527	123,735	(D)	(D)		
04021	PINAL	4,005	493,545	6,611	140,419		
04025	YAVAPAI			(D)	(D)		
04027	YUMA	236	(D)	(D)	(D)		
	ARKANSAS						
05001	ARKANSAS	1,714	145,599				
05007	BENTON			318	2,120		
05009	BOONE			(D)	(D)		
05017	CHICOT	1,540	81,050				
05021	CLAY	1,890	149,244				
05029	CONWAY	(D)	(D)				
05031	CRAIGHEAD	3,894	292,634	(D)	(D)		
05035	CRITTENDEN	11,200	1,124,183				
05037	CROSS	6,713	649,270	285	285		
05041	DESHA	3,003	251,631			(D)	(D)
05043	DREW	(D)	(D)	(D)	(D)		
05045	FAULKNER	(D)	(D)				
05047	FRANKLIN	(D)	(D)				
05049	FULTON					(D)	(D)
05055	GREENE	5,244	335,326				
05057	HEMPSTEAD			(D)	(D)		
05063	INDEPENDENCE	1,855	96,167				
05067	JACKSON	2,969	237,749	(D)	(D)		
05069	JEFFERSON	2,998	209,263	(D)	(D)		
05073	LAFAYETTE	(D)	(D)				
05075	LAWRENCE	2,743	212,160				
05077	LEE	11,587	1,037,115				
05079	LINCOLN	2,962	247,108				
05081	LITTLE RIVER	479	41,039				
05085	LONOKE	544	39,105	(D)	(D)		
05091	MILLER	(D)	(D)				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
05093	MISSISSIPPI	3,570	301,907				
05095	MONROE	8,674	646,628				
05105	PERRY			(D)	(D)		
05107	PHILLIPS	19,550	1,959,114				
05111	POINSETT	5,435	523,949			(D)	(D)
05117	PRAIRIE	2,705	210,045				
05119	PULASKI	740	46,770				
05121	RANDOLPH	819	65,581				
05123	ST. FRANCIS	18,179	1,628,189	(D)	(D)		
05143	WASHINGTON			440	3,104		
05145	WHITE	303	17,009	(D)	(D)		
05147	WOODRUFF	9,097	613,714				
05149	YELL			(D)	(D)		
	CALIFORNIA						
06019	FRESNO	(D)	(D)	4,967	79,742		
06021	GLENN	(D)	(D)	521	9,720		
06025	IMPERIAL			322	3,330		
06029	KERN	1,447	94,448	7,365	108,418		
06031	KINGS	5,107	485,718	11,272	153,815		
06039	MADERA			(D)	(D)		
06047	MERCED			4,136	60,672		
06065	RIVERSIDE	13	1,431	935	15,950		
06067	SACRAMENTO	(D)	(D)				
06071	SAN BERNARDINO			753	8,995		
06077	SAN JOAQUIN	242	17,406	958	13,757		
06089	SHASTA	(D)	(D)				
06095	SOLANO	356	29,355				
06097	SONOMA			250	4,032		
06099	STANISLAUS	930	80,764	3,180	49,735		
06101	SUTTER	996	112,390				
06107	TULARE	2,395	237,558	6,853	120,719		
06113	YOLO	1,041	86,769	(D)	(D)		
	COLORADO						
08001	ADAMS	912	18,865	(D)	(D)		
08005	ARAPAHOE	(D)	(D)				
08009	BACA	71,688	1,236,987	2,264	18,196		
08011	BENT	1,357	56,579	437	1,586		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
08013	BOULDER	(D)	(D)				
08017	CHEYENNE	18,973	327,754	506	2,490		
08025	CROWLEY	998	25,821	746	7,426		
08033	DOLORES			(D)	(D)		
08039	ELBERT	(D)	(D)				
08041	EL PASO	(D)	(D)				
08049	GRAND			(D)	(D)		
08055	HUERFANO			(D)	(D)		
08059	JEFFERSON	(D)	(D)				
08061	KIOWA	29,367	482,871				
08063	KIT CARSON	5,047	109,913	(D)	(D)		
08073	LINCOLN	1,004	12,993	(D)	(D)		
08075	LOGAN	(D)	(D)	(D)	(D)		
08077	MESA	(D)	(D)				
08087	MORGAN	(D)	(D)	1,161	11,260		
08089	OTERO	284	12,740	1,563	17,032		
08095	PHILLIPS	(D)	(D)				
08099	PROWERS	16,036	370,344	2,709	34,471		
08121	WASHINGTON	235	(D)				
08123	WELD	580	30,370	686	9,172		
08125	YUMA	(D)	(D)	(D)	(D)		
CONNECTICUT							
09011	NEW LONDON			(D)	(D)		
DELAWARE							
10001	KENT	(D)	(D)				
10003	NEW CASTLE	(D)	(D)				
10005	SUSSEX	323	20,637	(D)	(D)		
FLORIDA							
12001	ALACHUA	(D)	(D)	90	1,080		
12021	COLLIER			(D)	(D)		
12031	DUVAL			(D)	(D)		
12041	GILCHRIST	(D)	(D)	3,186	34,173		
12043	GLADES			(D)	(D)		
12047	HAMILTON	(D)	(D)				
12053	HERNANDO			(D)	(D)		
12057	HILLSBOROUGH			(D)	(D)		
12059	HOLMES	(D)	(D)	195	2,750		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
12063	JACKSON	(D)	(D)				
12065	JEFFERSON	(D)	(D)				
12067	LAFAYETTE	(D)	(D)	1,383	8,729		
12073	LEON	(D)	(D)				
12075	LEVY	(D)	(D)				
12079	MADISON	277	14,860	(D)	(D)		
12083	MARION	495	18,500	(D)	(D)		
12107	PUTNAM			(D)	(D)		
12119	SUMTER			(D)	(D)		
12121	SUWANNEE	422	15,948	1,854	16,358		
12131	WALTON	(D)	(D)				
	GEORGIA						
13001	APPLING			(D)	(D)		
13003	ATKINSON	(D)	(D)	(D)	(D)		
13005	BACON			(D)	(D)		
13007	BAKER	(D)	(D)	(D)	(D)		
13011	BANKS	(D)	(D)	(D)	(D)		
13017	BEN HILL	1,270	33,586				
13021	BIBB	193	9,400				
13023	BLECKLEY	608	25,127				
13027	BROOKS	466	24,775	881	11,248		
13033	BURKE	371	23,567	537	8,286		
13037	CALHOUN	2,667	133,229				
13049	CHARLTON			(D)	(D)		
13059	CLARKE	(D)	(D)	(D)	(D)		
13071	COLQUITT	363	22,550	(D)	(D)		
13077	COWETA	(D)	(D)				
13079	CRAWFORD			180	1,440		
13081	CRISP	6,279	266,683				
13087	DECATUR	959	50,640	(D)	(D)		
13091	DODGE	502	18,048				
13093	DOOLY	216	9,600	(D)	(D)		
13099	EARLY	(D)	(D)				
13103	EFFINGHAM	(D)	(D)				
13105	ELBERT	(D)	(D)				
13107	EMANUEL	(D)	(D)				
13115	FLOYD	(D)	(D)				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
13121	FULTON	(D)	(D)				
13131	GRADY	35	1,474	(D)	(D)		
13133	GREENE	(D)	(D)	(D)	(D)		
13143	HARALSON					(D)	(D)
13145	HARRIS	(D)	(D)				
13147	HART	(D)	(D)	(D)	(D)		
13153	HOUSTON	1,289	37,474	(D)	(D)		
13155	IRWIN	275	18,432				
13159	JASPER	90	3,219				
13161	JEFF DAVIS	(D)	(D)				
13163	JEFFERSON	723	55,841	65	800		
13165	JENKINS	(D)	(D)	135	1,636		
13167	JOHNSON	(D)	(D)				
13175	LAURENS	349	10,390	231	2,520		
13177	LEE	583	25,619	(D)	(D)		
13181	LINCOLN					(D)	(D)
13185	LOWNDES	(D)	(D)				
13189	MCDUFFIE	(D)	(D)	(D)	(D)		
13193	MACON	(D)	(D)	(D)	(D)		
13195	MADISON	(D)	(D)				
13197	MARION	183	10,896				
13199	MERIWETHER	(D)	(D)	(D)	(D)		
13201	MILLER	129	4,151	(D)	(D)		
13205	MITCHELL	1,232	52,923	176	2,598		
13209	MONTGOMERY	36	450				
13211	MORGAN	361	20,116	(D)	(D)		
13217	NEWTON	(D)	(D)				
13219	OCONEE	(D)	(D)	(D)	(D)		
13221	OGLETHORPE	110	5,500	(D)	(D)		
13225	PEACH	(D)	(D)				
13231	PIKE			(D)	(D)		
13235	PULASKI	1,917	124,732				
13237	PUTNAM			(D)	(D)		
13243	RANDOLPH	5,002	206,313				
13249	SCHLEY	(D)	(D)				
13251	SCREVEN	70	4,008	711	655		
13253	SEMINOLE	(D)	(D)				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
13261	SUMTER	280	20,150	(D)	(D)		
13265	TALIAFERRO	(D)	(D)				
13267	TATTNALL			(D)	(D)		
13269	TAYLOR	417	21,127				
13271	TELFAIR	303	16,744				
13273	TERRELL	1,563	81,869				
13275	THOMAS	926	48,024	655	13,100		
13277	TIFT	(D)	(D)	(D)	(D)		
13281	TOWNS					(D)	(D)
13283	TREUTLEN	(D)	(D)				
13287	TURNER	1,056	74,696				
13289	TWIGGS	(D)	(D)				
13299	WARE			(D)	(D)		
13301	WARREN	392	19,843	(D)	(D)		
13303	WASHINGTON	2,751	159,372	(D)	(D)		
13307	WEBSTER	87	5,100	(D)	(D)		
13309	WHEELER	392	13,877				
13311	WHITE			(D)	(D)		
13315	WILCOX	613	41,900	(D)	(D)		
13317	WILKES			419	4,590		
13321	WORTH	360	18,462	150	1,200		
	HAWAII						
15007	KAUAI	(D)	(D)				
	IDAHO						
16011	BINGHAM			(D)	(D)		
16027	CANYON	(D)	(D)	(D)	(D)		
16045	GEM			(D)	(D)		
16047	GOODING			(D)	(D)		
16067	MINIDOKA			(D)	(D)		
16073	OWYHEE	(D)	(D)	(D)	(D)		
16083	TWIN FALLS			(D)	(D)		
	ILLINOIS						
17001	ADAMS	(D)	(D)	115	1,222		
17003	ALEXANDER	(D)	(D)				
17005	BOND	290	19,608	84	(D)		
17009	BROWN			(D)	(D)		
17013	CALHOUN			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
17015	CARROLL			(D)	(D)		
17019	CHAMPAIGN	(D)	(D)				
17021	CHRISTIAN	(D)	(D)				
17023	CLARK	555	23,480	(D)	(D)		
17025	CLAY	637	27,888				
17027	CLINTON	309	13,569	34	300		
17033	CRAWFORD	720	49,985				
17037	DEKALB	(D)	(D)				
17041	DOUGLAS	(D)	(D)				
17047	EDWARDS	(D)	(D)				
17049	EFFINGHAM	299	11,680	172	1,392		
17051	FAYETTE	505	32,753	(D)	(D)		
17053	FORD			(D)	(D)		
17055	FRANKLIN	(D)	(D)				
17059	GALLATIN	999	74,263				
17061	GREENE	(D)	(D)				
17063	GRUNDY			(D)	(D)		
17065	HAMILTON	347	14,973	(D)	(D)		
17071	HENDERSON			(D)	(D)		
17073	HENRY	(D)	(D)				
17077	JACKSON	3,065	220,814	77	589		
17079	JASPER	(D)	(D)				
17081	JEFFERSON	1,991	116,122				
17083	JERSEY	(D)	(D)	(D)	(D)		
17085	JO DAVIESS			(D)	(D)		
17087	JOHNSON	(D)	(D)				
17091	KANKAKEE			(D)	424		
17095	KNOX	(D)	(D)				
17101	LAWRENCE	252	12,472				
17103	LEE			(D)	(D)		
17105	LIVINGSTON	(D)	(D)	(D)	(D)		
17107	LOGAN	656	36,733	(D)	(D)		
17109	MCDONOUGH	(D)	(D)	(D)	(D)		
17111	MCHENRY	16	610				
17113	MCLEAN	347	19,270				
17115	MACON			(D)	(D)		
17117	MACOUPIN			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
17119	MADISON	389	10,183	(D)	(D)		
17121	MARION	1,398	80,952				
17125	MASON	140	7,062				
17129	MENARD	(D)	(D)				
17131	MERCER	(D)	(D)	(D)	(D)		
17133	MONROE	1,080	55,788	(D)	(D)		
17135	MONTGOMERY			(D)	(D)		
17139	MOULTRIE	(D)	(D)	69	473		
17143	PEORIA	(D)	(D)	(D)	(D)		
17145	PERRY	504	(D)				
17147	PIATT			(D)	(D)		
17149	PIKE	618	28,660				
17151	POPE	(D)	(D)				
17155	PUTNAM	(D)	(D)				
17157	RANDOLPH	533	34,634	180	2,600		
17159	RICHLAND			(D)	(D)		
17163	ST. CLAIR	1,570	99,438	(D)	(D)		
17165	SALINE	365	23,567				
17171	SCOTT	84	(D)	(D)	(D)		
17173	SHELBY	(D)	(D)	(D)	(D)		
17177	STEPHENSON			(D)	(D)		
17179	TAZEWELL	(D)	(D)				
17181	UNION	(D)	(D)	(D)	(D)		
17185	WABASH	115	4,850				
17187	WARREN			(D)	(D)		
17189	WASHINGTON	729	51,198	199	2,450		
17191	WAYNE	2,151	152,018	(D)	(D)		
17193	WHITE	2,783	187,216				
17199	WILLIAMSON	478	41,458				
17201	WINNEBAGO	(D)	(D)				
17203	WOODFORD			(D)	(D)		
	INDIANA						
18001	ADAMS	(D)	(D)	126	922		
18003	ALLEN			(D)	(D)		
18015	CARROLL					(D)	(D)
18021	CLAY	(D)	(D)	(D)	(D)		
18023	CLINTON	(D)	(D)				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
18027	DAVIESS			(D)	(D)		
18035	DELAWARE			(D)	(D)		
18037	DUBOIS	(D)	(D)	(D)	(D)		
18039	ELKHART			55	620		
18049	FULTON	(D)	(D)	(D)	(D)		
18051	GIBSON	1,525	140,727				
18055	GREENE	531	25,558				
18059	HANCOCK	(D)	(D)	(D)	(D)		
18063	HENDRICKS	(D)	(D)				
18067	HOWARD			(D)	(D)		
18069	HUNTINGTON			(D)	(D)		
18071	JACKSON			(D)	(D)		
18073	JASPER	(D)	(D)				
18081	JOHNSON	(D)	(D)				
18083	KNOX	1,093	58,312				
18085	KOSCIUSKO			(D)	(D)		
18087	LAGRANGE			168	1,067	(D)	(D)
18091	LAPORTE			(D)	(D)		
18093	LAWRENCE	(D)	(D)				
18099	MARSHALL			55	476	(D)	(D)
18101	MARTIN			(D)	(D)		
18107	MONTGOMERY	(D)	(D)				
18109	MORGAN	(D)	(D)				
18111	NEWTON	(D)	(D)				
18113	NOBLE	(D)	(D)	(D)	(D)		
18121	PARKE	3	78	(D)	(D)		
18123	PERRY			(D)	(D)	(D)	(D)
18129	POSEY	436	20,604				
18133	PUTNAM	(D)	(D)				
18135	RANDOLPH			(D)	(D)		
18137	RIPLEY			(D)	(D)	(D)	(D)
18139	RUSH			(D)	(D)		
18147	SPENCER	(D)	(D)	(D)	(D)		
18151	STEUBEN			(D)	(D)		
18153	SULLIVAN	(D)	(D)				
18155	SWITZERLAND			(D)	(D)		
18157	TIPPECANOE	(D)	(D)				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
18161	UNION	(D)	(D)				
18163	VANDERBURGH	(D)	(D)				
18165	VERMILLION	(D)	(D)				
18167	VIGO	655	31,205				
18169	WABASH	(D)	(D)	(D)	(D)		
18171	WARREN	(D)	(D)				
18179	WELLS			(D)	(D)		
18183	WHITLEY			(D)	(D)		
	IOWA						
19013	BLACK HAWK	(D)	(D)				
19015	BOONE	(D)	(D)				
19019	BUCHANAN			(D)	(D)		
19023	BUTLER			(D)	(D)		
19025	CALHOUN			(D)	(D)		
19031	CEDAR	(D)	(D)	(D)	(D)		
19033	CERRO GORDO	(D)	(D)				
19039	CLARKE	(D)	(D)				
19043	CLAYTON			(D)	(D)		
19051	DAVIS			69	385		
19055	DELAWARE			(D)	(D)		
19061	DUBUQUE	(D)	(D)				
19067	FLOYD			(D)	(D)		
19095	IOWA	(D)	(D)	95	1,680		
19097	JACKSON			(D)	(D)		
19099	JASPER			(D)	(D)		
19109	KOSSUTH	(D)	(D)				
19121	MADISON			(D)	(D)		
19131	MITCHELL	(D)	(D)				
19137	MONTGOMERY	(D)	(D)				
19141	O'BRIEN	(D)	(D)				
19153	POLK	(D)	(D)	(D)	(D)		
19155	POTTAWATTAMIE	(D)	(D)				
19167	SIOUX			(D)	(D)		
19169	STORY	188	22,216	(D)	(D)		
19175	UNION	(D)	(D)				
19181	WARREN	(D)	(D)				
19183	WASHINGTON			(D)	(D)	(D)	(D)

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
19191	WINNESHIEK	(D)	(D)	(D)	(D)		
19193	WOODBURY			(D)	(D)		
	KANSAS						
20001	ALLEN	844	40,993	421	1,468		
20003	ANDERSON	1,698	52,357	1,212	12,302		
20005	ATCHISON	206	6,091	136	913		
20007	BARBER	6,106	229,802	805	10,533		
20009	BARTON	54,094	2,283,617	3,832	28,920		
20011	BOURBON	233	6,120	340	3,347		
20013	BROWN	(D)	(D)				
20015	BUTLER	13,077	402,242	1,264	9,649		
20017	CHASE	300	13,670	320	3,254		
20021	CHEROKEE	2,859	135,785				
20023	CHEYENNE	7,008	242,046	166	2,096		
20025	CLARK	10,616	319,932	778	5,782		
20027	CLAY	19,109	1,157,019	1,169	8,767		
20029	CLOUD	23,759	1,470,237	544	5,609		
20031	COFFEY	1,468	41,416	792	(D)		
20033	COMANCHE	12,518	484,161	3,018	23,616		
20035	COWLEY	23,607	622,918	122	586		
20037	CRAWFORD	1,087	29,428	(D)	(D)		
20039	DECATUR	7,447	294,558	823	(D)		
20041	DICKINSON	29,505	1,329,474	4,303	34,268		
20045	DOUGLAS	247	4,896	120	900		
20047	EDWARDS	16,912	769,428	288	3,692		
20049	ELK	674	15,835	(D)	(D)		
20051	ELLIS	34,933	1,040,537	2,972	18,417		
20053	ELLSWORTH	26,172	1,092,319	970	10,481		
20055	FINNEY	67,606	2,488,872	2,184	22,451		
20057	FORD	74,915	3,379,161	2,386	34,097		
20059	FRANKLIN	1,080	26,381	934	9,679		
20061	GEARY	2,441	150,286	449	3,401		
20063	GOVE	34,586	1,234,797	2,653	25,013		
20065	GRAHAM	41,780	1,619,712	1,344	15,833		
20067	GRANT	8,623	515,544	368	7,399		
20069	GRAY	65,573	3,296,480	1,786	42,861		
20071	GREELEY	34,647	997,688	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
20073	GREENWOOD	1,409	40,132	310	550		
20075	HAMILTON	33,002	904,027	7,116	83,132		
20077	HARPER	12,347	405,514	1,643	9,551		
20079	HARVEY	20,697	738,302	2,894	17,371		
20081	HASKELL	26,377	1,201,298	1,267	25,036		
20083	HODGEMAN	26,370	1,165,798	3,381	57,406		
20085	JACKSON	1,587	77,470	420	1,010		
20087	JEFFERSON	1,566	58,694	336	3,114		
20089	JEWELL	42,241	3,247,094	1,641	18,925		
20091	JOHNSON	162	3,051	(D)	(D)		
20093	KEARNY	45,823	1,023,987	(D)	(D)		
20095	KINGMAN	15,409	749,449	1,091	4,711		
20097	KIOWA	22,658	1,388,509	879	6,415		
20099	LABETTE	2,667	163,996	101	892		
20101	LANE	24,813	681,022	999	14,494		
20103	LEAVENWORTH	(D)	(D)	(D)	(D)		
20105	LINCOLN	29,678	1,313,401	3,952	36,255		
20107	LINN	629	22,392				
20109	LOGAN	26,491	1,051,042	1,703	10,258		
20111	LYON	1,734	39,747	354	2,621		
20113	MCPHERSON	27,647	1,031,953	1,734	14,917		
20115	MARION	26,431	815,933	3,916	28,942		
20117	MARSHALL	6,915	498,694	382	3,275		
20119	MEADE	26,351	1,316,491	529	5,350		
20121	MIAMI	2,981	67,344	176	3,760		
20123	MITCHELL	39,139	2,184,259	2,273	32,206		
20125	MONTGOMERY	613	30,058	650	3,325		
20127	MORRIS	7,311	338,635	2,343	14,232		
20129	MORTON	30,404	1,090,449	409	2,756		
20131	NEMAHA	1,086	61,488	1,071	10,467		
20133	NEOSHO	1,146	62,507	129	1,696		
20135	NESS	50,338	1,967,056	2,270	17,800		
20137	NORTON	12,803	640,710	2,641	16,662		
20139	OSAGE	3,422	110,345	1,468	6,344		
20141	OSBORNE	31,828	1,436,135	2,363	40,417		
20143	OTTAWA	25,494	1,108,076	1,321	13,577		
20145	PAWNEE	45,719	1,822,610	1,395	14,963		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
20147	PHILLIPS	32,266	1,495,961	811	7,523		
20149	POTTAWATOMIE	3,131	149,474	406	3,959		
20151	PRATT	25,035	1,069,270	443	1,254		
20153	RAWLINS	18,755	624,709	1,865	13,256		
20155	RENO	44,695	1,660,670	2,058	17,708		
20157	REPUBLIC	15,618	1,185,122	497	(D)		
20159	RICE	35,080	1,368,983	1,578	16,336		
20161	RILEY	7,563	515,381	357	3,059		
20163	ROOKS	62,529	2,538,869	2,033	17,823		
20165	RUSH	51,233	2,000,653	1,554	13,485		
20167	RUSSELL	35,357	1,375,138	1,549	9,430		
20169	SALINE	18,720	885,244	1,476	8,703		
20171	SCOTT	54,648	1,716,196	628	9,130		
20173	SEDGWICK	33,904	1,223,966	2,104	10,717		
20175	SEWARD	30,197	1,637,173	490	959		
20177	SHAWNEE	598	17,004				
20179	SHERIDAN	25,142	1,204,123	2,650	24,914		
20181	SHERMAN	11,484	538,665	158	225		
20183	SMITH	44,946	2,424,800	1,705	28,714		
20185	STAFFORD	14,267	469,907	866	7,496		
20187	STANTON	26,580	670,168	2,101	23,248		
20189	STEVENS	27,034	963,027	(D)	(D)		
20191	SUMNER	35,783	929,115	2,113	13,002		
20193	THOMAS	17,552	662,349	3,235	14,523		
20195	TREGO	45,463	1,173,887	4,857	52,706		
20197	WABAUNSEE	936	25,913	310	3,050		
20199	WALLACE	16,619	496,106	1,279	15,651		
20201	WASHINGTON	26,694	1,786,798	1,784	18,433		
20203	WICHITA	39,106	1,479,495	142	(D)		
20205	WILSON	341	17,488				
20207	WOODSON	1,512	48,341	852	5,697		
KENTUCKY							
21003	ALLEN			(D)	(D)	50	9551
21007	BALLARD	(D)	(D)	(D)	(D)		
21009	BARREN			27	216		
21011	BATH			(D)	(D)	(D)	(D)
21017	BOURBON	(D)	(D)	135	1,140		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
21019	BOYD			(D)	(D)		
21023	BRACKEN	(D)	(D)				
21027	BRECKINRIDGE	(D)	(D)	12	57		
21029	BULLITT	(D)	(D)				
21031	BUTLER			(D)	(D)		
21033	CALDWELL	(D)	(D)			(D)	(D)
21035	CALLOWAY			(D)	(D)		
21037	CAMPBELL			(D)	(D)		
21039	CARLISLE	(D)	(D)	(D)	(D)		
21041	CARROLL					(D)	(D)
21045	CASEY					62	10276
21047	CHRISTIAN			463	6,206		
21049	CLARK					(D)	(D)
21051	CLAY					(D)	(D)
21055	CRITTENDEN	355	23,963				
21059	DAVIESS	(D)	(D)				
21065	ESTILL			(D)	(D)		
21073	FRANKLIN	(D)	(D)			(D)	(D)
21083	GRAVES	(D)	(D)	(D)	(D)		
21085	GRAYSON			(D)	(D)		
21087	GREEN			(D)	(D)		
21089	GREENUP	(D)	(D)			(D)	(D)
21091	HANCOCK					(D)	(D)
21093	HARDIN	54	4,050	(D)	(D)		
21097	HARRISON					(D)	(D)
21099	HART			(D)	(D)		
21101	HENDERSON	(D)	(D)				
21103	HENRY	(D)	(D)	(D)	(D)		
21105	HICKMAN	(D)	(D)				
21107	HOPKINS	359	(D)				
21123	LARUE	(D)	(D)	(D)	(D)	(D)	(D)
21127	LAWRENCE			(D)	(D)		
21133	LETCHER					(D)	(D)
21135	LEWIS	(D)	(D)				
21137	LINCOLN			9	90		
21141	LOGAN			306	4,330		
21145	MCCRACKEN	(D)	(D)	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
21149	MCLEAN	395	34,514				
21151	MADISON			29	192		
21157	MARSHALL					(D)	(D)
21163	MEADE	(D)	(D)	(D)	(D)		
21165	MENIFEE					(D)	(D)
21171	MONROE			(D)	(D)		
21173	MONTGOMERY					(D)	(D)
21175	MORGAN					21	1330
21177	MUHLENBERG	(D)	(D)	(D)	(D)		
21179	NELSON			(D)	(D)		
21183	OHIO	(D)	(D)	(D)	(D)	5	1286
21189	OWSLEY					(D)	(D)
21197	POWELL			(D)	(D)		
21199	PULASKI	(D)	(D)	(D)	360		
21207	RUSSELL			(D)	(D)		
21209	SCOTT	(D)	(D)			(D)	(D)
21211	SHELBY	(D)	(D)	(D)	(D)		
21217	TAYLOR					(D)	(D)
21219	TODD	113	6,585	577	8,190	3	450
21221	TRIGG	56	3,500	150	2,278	29	4677
21225	UNION	413	31,501	21	216		
21227	WARREN			(D)	(D)		
21231	WAYNE			(D)	(D)		
21233	WEBSTER	366	22,468				
21235	WHITLEY	(D)	(D)				
	LOUISIANA						
22001	ACADIA	(D)	(D)				
22009	AVOYELLES	29,236	2,951,204				
22011	BEAUREGARD	(D)	(D)				
22015	BOSSIER	409	17,902				
22019	CALCASIEU	(D)	(D)				
22025	CATAHOULA	23,019	2,095,055				
22029	CONCORDIA	15,470	1,728,046				
22033	EAST BATON ROUGE	(D)	(D)				
22035	EAST CARROLL	886	98,714				
22039	EVANGELINE	1,430	134,318				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
22041	FRANKLIN	941	63,904				
22043	GRANT	401	40,958				
22047	IBERVILLE	(D)	(D)				
22053	JEFFERSON DAVIS	1,391	150,421				
22055	LAFAYETTE	(D)	(D)				
22065	MADISON	1,725	212,832				
22067	MOREHOUSE	4,375	397,489				
22069	NATCHITOCHES	1,854	166,976				
22073	OUACHITA	4,910	489,220				
22077	POINTE COUPEE	2,459	272,120				
22079	RAPIDES	10,490	992,753				
22083	RICHLAND	1,397	121,840				
22097	ST. LANDRY	13,639	1,376,597				
22099	ST. MARTIN	726	72,820				
22105	TANGIPAHOA			208	3,000		
22107	TENSAS	6,898	798,568				
22117	WASHINGTON			(D)	(D)		
22123	WEST CARROLL	804	110,610	(D)	(D)		
	MAINE						
23019	PENOBSCOT			(D)	(D)		
23031	YORK	(D)	(D)				
	MARYLAND						
24001	ALLEGANY			(D)	(D)		
24003	ANNE ARUNDEL	197	13,190	(D)	(D)		
24005	BALTIMORE	(D)	(D)				
24009	CALVERT	(D)	(D)				
24011	CAROLINE	2,217	150,690	(D)	(D)		
24013	CARROLL			215	1,004		
24015	CECIL			(D)	(D)		
24017	CHARLES	4,542	169,853	(D)	(D)		
24019	DORCHESTER	2,469	173,940	(D)	(D)	(D)	(D)
24021	FREDERICK	524	18,598	282	4,706		
24023	GARRETT			42	496		
24025	HARFORD	(D)	(D)	(D)	(D)		
24027	HOWARD			(D)	(D)		
24029	KENT	693	51,571	(D)	(D)		
24031	MONTGOMERY	(D)	(D)	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
24033	PRINCE GEORGE'S	(D)	(D)	(D)	(D)		
24035	QUEEN ANNE'S	378	28,724	(D)	(D)		
24037	ST. MARY'S	78	3,560	(D)	(D)		
24041	TALBOT	1,509	82,186	(D)	(D)		
24043	WASHINGTON	887	54,007	823	16,277		
24045	WICOMICO	295	16,752				
24047	WORCESTER	(D)	(D)				
	MASSACHUSETTS						
25003	BERKSHIRE			(D)	(D)		
25005	BRISTOL			(D)	(D)		
	MICHIGAN						
26005	ALLEGAN			(D)	(D)		
26007	ALPENA			(D)	(D)		
26009	ANTRIM	(D)	(D)	(D)	(D)		
26011	ARENAC			(D)	(D)		
26015	BARRY			(D)	(D)		
26023	BRANCH			72	520		
26025	CALHOUN			(D)	(D)		
26029	CHARLEVOIX			(D)	(D)		
26031	CHEBOYGAN			(D)	(D)		
26037	CLINTON	(D)	(D)	(D)	(D)		
26041	DELTA			(D)	(D)		
26045	EATON	(D)	(D)	48	204		
26047	EMMET			(D)	(D)		
26049	GENESEE			(D)	(D)		
26055	GRAND TRAVERSE			(D)	(D)		
26057	GRATIOT			(D)	(D)		
26059	HILLSDALE	(D)	(D)	184	379		
26063	HURON	(D)	(D)				
26067	IONIA			116	1,345		
26069	IOSCO			(D)	(D)		
26073	ISABELLA			424	2,369		
26075	JACKSON	244	20,123				
26077	KALAMAZOO			(D)	(D)		
26079	KALKASKA	(D)	(D)				
26081	KENT			(D)	(D)		
26087	LAPEER	60	2,040	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
26089	LEELANAU			(D)	(D)		
26091	LENAWEE	(D)	(D)	(D)	(D)		
26097	MACKINAC			(D)	(D)		
26101	MANISTEE			(D)	(D)		
26105	MASON			(D)	(D)		
26107	MECOSTA			(D)	(D)		
26109	MENOMINEE	(D)	(D)	(D)	(D)		
26111	MIDLAND			(D)	(D)		
26113	MISSAUKEE			238	1,065		
26115	MONROE			(D)	(D)		
26119	MONTMORENCY			(D)	(D)		
26121	MUSKEGON			(D)	(D)		
26123	NEWAYGO			(D)	(D)		
26127	OCEANA			60	335		
26129	OGEMAW	(D)	(D)	(D)	(D)		
26133	OSCEOLA			95	265		
26135	OSCODA			(D)	(D)		
26137	OTSEGO			(D)	(D)		
26139	OTTAWA	(D)	(D)				
26141	PRESQUE ISLE	(D)	(D)	(D)	(D)		
26145	SAGINAW			189	4,260		
26147	ST. CLAIR			(D)	(D)		
26149	ST. JOSEPH			(D)	(D)		
26151	SANILAC			17	121		
26155	SHIAWASSEE			(D)	(D)		
26157	TUSCOLA	(D)	(D)				
26159	VAN BUREN			118	648		
26161	WASHTENAW	(D)	(D)				
26165	WEXFORD			(D)	(D)		
	MINNESOTA						
27005	BECKER			(D)	(D)		
27023	CHIPPEWA	54	827				
27033	COTTONWOOD			(D)	(D)		
27039	DODGE			(D)	(D)		
27055	HOUSTON			(D)	(D)		
27097	MORRISON	(D)	(D)				
27121	POPE	(D)	(D)	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
27147	STEELE			(D)	(D)		
27149	STEVENS	67	1,036				
27151	SWIFT			(D)	(D)		
27153	TODD			50	310		
27159	WADENA			240	1,200		
	MISSISSIPPI						
28003	ALCORN	(D)	(D)				
28005	AMITE			(D)	(D)		
28011	BOLIVAR	1,974	158,861	(D)	(D)		
28013	CALHOUN	234	17,980				
28015	CARROLL	(D)	(D)				
28017	CHICKASAW	(D)	(D)				
28019	CHOCTAW	30	1,926				
28021	CLAIBORNE	(D)	(D)			(D)	(D)
28025	CLAY	(D)	(D)	(D)	(D)		
28027	COAHOMA	1,584	109,446				
28029	COPIAH			(D)	(D)		
28033	DESOTO	6,858	584,046				
28043	GRENADA	(D)	(D)				
28049	HINDS	(D)	(D)				
28051	HOLMES	(D)	(D)				
28053	HUMPHREYS	1,594	145,198				
28055	ISSAQUENA	(D)	(D)				
28061	JASPER			(D)	(D)		
28065	JEFFERSON DAVIS	(D)	(D)				
28069	KEMPER	(D)	(D)				
28071	LAFAYETTE	(D)	(D)				
28077	LAWRENCE	(D)	(D)				
28081	LEE	1,006	77,993	(D)	(D)		
28083	LEFLORE	(D)	(D)				
28085	LINCOLN	(D)	(D)				
28087	LOWNDES			(D)	(D)		
28089	MADISON	(D)	(D)				
28091	MARION			(D)	(D)	(D)	(D)
28093	MARSHALL	1,606	111,027	(D)	(D)		
28103	NOXUBEE	(D)	(D)	(D)	(D)		
28107	PANOLA	1,942	135,770	300	1,017		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
28115	PONTOTOC	762	58,354				
28119	QUITMAN	7,246	651,691				
28125	SHARKEY	(D)	(D)				
28129	SMITH					(D)	(D)
28133	SUNFLOWER	2,736	231,299			(D)	(D)
28135	TALLAHATCHIE	870	79,546				
28137	TATE	1,563	112,910				
28143	TUNICA	7,059	565,262				
28145	UNION	298	21,345	30	102		
28147	WALTHALL			(D)	(D)		
28151	WASHINGTON	4,099	396,037				
28153	WAYNE					(D)	(D)
28161	YALOBUSHA	100	4,026				
28163	YAZOO	1,670	186,350				
	MISSOURI						
29001	ADAIR	493	28,448	(D)	(D)		
29003	ANDREW	383	15,076				
29005	ATCHISON	(D)	(D)				
29007	AUDRAIN	6,419	364,435	(D)	(D)	(D)	(D)
29009	BARRY			(D)	(D)		
29011	BARTON	1,532	66,410				
29013	BATES	307	26,077	(D)	(D)		
29015	BENTON	264	10,034	(D)	(D)	(D)	(D)
29017	BOLLINGER	(D)	(D)	(D)	(D)		
29019	BOONE	1,068	47,444	(D)	(D)		
29021	BUCHANAN	282	17,009	(D)	(D)		
29023	BUTLER	360	18,939				
29025	CALDWELL	1,962	99,529				
29027	CALLAWAY	1,664	49,563				
29031	CAPE GIRARDEAU	(D)	(D)	75	768		
29033	CARROLL	444	(D)	(D)	(D)		
29037	CASS	(D)	(D)	(D)	(D)	(D)	(D)
29041	CHARITON	66	4,830				
29043	CHRISTIAN			(D)	(D)		
29045	CLARK	(D)	(D)	(D)	(D)		
29047	CLAY			(D)	(D)		
29051	COLE	(D)	(D)	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
29053	COOPER	120	2,640	(D)	(D)		
29055	CRAWFORD	(D)	(D)				
29057	DADE	1,294	50,028	(D)	(D)		
29059	DALLAS	(D)	(D)	118	1,181	(D)	(D)
29061	DAVIESS	404	18,777	(D)	(D)		
29063	DEKALB	707	42,516				
29067	DOUGLAS			(D)	(D)		
29069	DUNKLIN	4,085	264,659				
29071	FRANKLIN	1,331	71,160				
29073	GASCONADE	575	31,245				
29075	GENTRY	113	10,246	35	(D)		
29077	GREENE	(D)	(D)	(D)	(D)		
29079	GRUNDY	168	11,194	(D)	(D)		
29081	HARRISON	108	4,477				
29083	HENRY	1,256	54,748	(D)	(D)		
29085	HICKORY	(D)	(D)	390	1,950		
29089	HOWARD	(D)	(D)				
29091	HOWELL	(D)	(D)	117	732		
29093	IRON	(D)	(D)				
29095	JACKSON	74	4,310				
29097	JASPER	314	11,136	(D)	(D)		
29099	JEFFERSON	83	4,000	100	1,010	(D)	(D)
29101	JOHNSON	120	5,948	125	1,740	(D)	(D)
29103	KNOX	465	20,940	58	499	(D)	(D)
29105	LACLEDE	(D)	(D)	518	8,156		
29107	LAFAYETTE	(D)	(D)	63	93		
29109	LAWRENCE	108	5,280	204	1,388		
29111	LEWIS	(D)	(D)	25	150		
29113	LINCOLN	2,555	82,013	(D)	(D)		
29115	LINN	510	28,592	18	110	(D)	(D)
29117	LIVINGSTON	2,625	195,122	(D)	(D)		
29119	MCDONALD	(D)	(D)	(D)	(D)		
29121	MACON	(D)	(D)				
29125	MARIES	571	20,022	(D)	(D)	(D)	(D)
29129	MERCER	60	1,191	(D)	(D)		
29131	MILLER	142	6,316	180	2,000		
29133	MISSISSIPPI	2,240	195,069				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
29135	MONITEAU	232	7,566	214	2,135		
29137	MONROE	740	36,617	195	1,700		
29139	MONTGOMERY	1,558	74,450				
29141	MORGAN	220	10,910	231	1,620		
29143	NEW MADRID	3,983	291,410	(D)	(D)		
29145	NEWTON	85	3,750	257	1,336		
29147	NODAWAY	(D)	(D)	(D)	(D)		
29151	OSAGE	522	23,284	466	3,968		
29155	PEMISCOT	2,924	235,009	(D)	(D)		
29157	PERRY			(D)	(D)		
29159	PETTIS	851	39,535				
29161	PHELPS	(D)	(D)				
29163	PIKE	(D)	(D)	(D)	(D)		
29165	PLATTE	359	16,138				
29167	POLK	218	10,900	(D)	(D)	(D)	(D)
29171	PUTNAM	(D)	(D)				
29173	RALLS	(D)	(D)				
29175	RANDOLPH	223	13,653				
29177	RAY	267	18,484				
29181	RIPLEY	(D)	(D)				
29183	ST. CHARLES	58	3,110				
29185	ST. CLAIR	739	42,296	(D)	(D)		
29186	STE. GENEVIEVE	(D)	(D)				
29187	ST. FRANCOIS	(D)	(D)				
29195	SALINE	163	(D)				
29199	SCOTLAND	60	1,191	93	1,273	(D)	(D)
29201	SCOTT	(D)	(D)	(D)	(D)		
29205	SHELBY	713	60,240	(D)	(D)		
29207	STODDARD	877	58,780	(D)	(D)		
29209	STONE			200	1,720		
29213	TANEY			(D)	(D)		
29215	TEXAS	(D)	(D)	225	1,434		
29217	VERNON	705	22,922	142	584	(D)	(D)
29219	WARREN	230	9,974	(D)	(D)	(D)	(D)
29225	WEBSTER	228	5,414	776	5,661	(D)	(D)
29229	WRIGHT	(D)	(D)	(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
MONTANA							
30017	CUSTER			(D)	(D)		
30065	MUSSELSHELL			(D)	(D)		
NEBRASKA							
31001	ADAMS	1,047	82,957				
31003	ANTELOPE	(D)	(D)	(D)	(D)		
31007	BANNER	(D)	(D)	286	3,018		
31011	BOONE	(D)	(D)				
31013	BOX BUTTE	(D)	(D)	(D)	(D)		
31015	BOYD	(D)	(D)	270	2,743		
31019	BUFFALO	204	24,061	401	632		
31021	BURT	(D)	(D)				
31023	BUTLER	125	8,751	138	(D)		
31025	CASS	59	2,986	(D)	(D)		
31027	CEDAR	(D)	(D)	(D)	(D)		
31029	CHASE	1,522	45,547	135	1,876		
31031	CHERRY			474	8,459		
31033	CHEYENNE	1,303	31,970	(D)	(D)		
31035	CLAY	765	51,748	(D)	(D)		
31037	COLFAX	(D)	(D)	(D)	(D)		
31039	CUMING	(D)	(D)	45	(D)		
31041	CUSTER	1,253	60,285	388	4,085		
31045	DAWES	(D)	(D)				
31047	DAWSON	198	11,637	229	2,967		
31049	DEUEL	(D)	(D)	88	(D)		
31053	DODGE	103	10,170				
31057	DUNDY	3,637	211,652	117	268		
31059	FILLMORE	1,346	77,084	98	1,400		
31061	FRANKLIN	567	27,983	285	2,597		
31063	FRONTIER	2,777	85,044	613	2,206		
31065	FURNAS	3,160	165,931	300	1,700		
31067	GAGE	3,347	232,884	112	642		
31069	GARDEN	(D)	(D)				
31071	GARFIELD			(D)	(D)		
31073	GOSPER	(D)	(D)	(D)	(D)		
31077	GREELEY	(D)	(D)	342	964		
31079	HALL	400	34,596	748	1,968		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
31081	HAMILTON	224	13,617				
31083	HARLAN	1,497	83,003				
31085	HAYES	1,117	54,280				
31087	HITCHCOCK	4,541	274,561	(D)	(D)		
31089	HOLT	(D)	(D)	112	769		
31093	HOWARD	370	19,645				
31095	JEFFERSON	1,364	82,308	274	5,817		
31097	JOHNSON	450	30,174	(D)	(D)		
31099	KEARNEY	452	45,919				
31101	KEITH	(D)	(D)				
31103	KEYA PAHA	(D)	(D)	(D)	(D)		
31105	KIMBALL	995	47,317				
31107	KNOX	(D)	1,862	404	2,621		
31109	LANCASTER	263	19,365				
31111	LINCOLN	450	16,101	369	5,460		
31115	LOUP			(D)	(D)		
31117	MCPHERSON			(D)	(D)		
31119	MADISON	63	(D)	49	(D)		
31121	MERRICK	(D)	(D)				
31123	MORRILL	184	10,010	818	(D)		
31125	NANCE	(D)	(D)				
31127	NEMAHA			(D)	(D)		
31129	NUCKOLLS	3,733	308,308	622	7,774		
31133	PAWNEE	480	34,838				
31135	PERKINS	670	17,911	255	2,080		
31137	PHELPS	358	29,972				
31139	PIERCE			298	4,946		
31141	PLATTE	(D)	(D)	(D)	(D)		
31143	POLK	609	66,309				
31145	RED WILLOW	5,412	239,779	231	1,552		
31147	RICHARDSON	(D)	(D)				
31149	ROCK			(D)	(D)		
31151	SALINE	1,116	56,510	49	419		
31155	SAUNDERS	71	3,347	28	300		
31157	SCOTTS BLUFF	90	5,850	223	3,239		
31159	SEWARD	1,797	161,904	(D)	(D)		
31161	SHERIDAN	300	9,850	130	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
31163	SHERMAN	(D)	(D)	(D)	(D)		
31165	SIOUX	(D)	(D)	(D)	(D)		
31167	STANTON			(D)	(D)		
31169	THAYER	2,074	168,345	(D)	(D)		
31175	VALLEY	586	40,400	502	7,680		
31179	WAYNE	(D)	(D)				
31181	WEBSTER	2,276	166,401	242	1,742		
31183	WHEELER	(D)	(D)	(D)	(D)		
31185	YORK	1,282	92,165	(D)	(D)		
NEVADA							
32001	CHURCHILL			(D)	(D)		
NEW HAMPSHIRE							
33005	CHESHIRE	(D)	(D)				
33015	ROCKINGHAM			(D)	(D)		
NEW JERSEY							
34001	ATLANTIC			(D)	(D)		
34009	CAPE MAY			(D)	(D)		
34011	CUMBERLAND	703	16,646				
34015	GLOUCESTER	(D)	(D)	(D)	(D)		
34019	HUNTERDON	20	300	22	64		
34025	MONMOUTH	(D)	(D)	(D)	(D)		
34033	SALEM	(D)	7,300	42	303		
34035	SOMERSET	(D)	(D)				
NEW MEXICO							
35001	BERNALILLO			84	1,512		
35005	CHAVES	204	14,011	2,023	33,565		
35009	CURRY	12,786	476,438	7,375	104,734		
35011	DE BACA	24	480				
35013	DONA ANA	(D)	(D)	56	925		
35015	EDDY	(D)	(D)	(D)	(D)		
35023	HIDALGO			(D)	(D)		
35025	LEA	442	18,564				
35029	LUNA	1,368	155,874				
35037	QUAY	(D)	(D)	382	4,270		
35041	ROOSEVELT	4,241	70,067	5,400	56,225		
35045	SAN JUAN	(D)	(D)				
35051	SIERRA			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
35053	SOCORRO	(D)	(D)	(D)	(D)		
35057	TORRANCE			450	5,020		
35059	UNION	(D)	(D)	1,420	26,220		
35061	VALENCIA	(D)	(D)	(D)	(D)		
	NEW YORK						
36003	ALLEGANY	(D)	(D)				
36007	BROOME			(D)	(D)		
36009	CATTARAUGUS			69	580		
36011	CAYUGA			150	556		
36013	CHAUTAUQUA			253	2,745		
36019	CLINTON	(D)	(D)	(D)	(D)		
36021	COLUMBIA	(D)	(D)	300	2,261		
36023	CORTLAND			100	768		
36025	DELAWARE			(D)	(D)		
36027	DUTCHESS			(D)	(D)		
36037	GENESEE	(D)	(D)	213	1,023		
36043	HERKIMER			18	204		
36045	JEFFERSON	(D)	(D)	(D)	(D)		
36049	LEWIS			(D)	(D)		
36051	LIVINGSTON			(D)	(D)		
36053	MADISON			12	84		
36057	MONTGOMERY			87	720		
36063	NIAGARA			75	298		
36065	ONEIDA			11	38		
36067	ONONDAGA			(D)	(D)		
36069	ONTARIO			30	400		
36071	ORANGE			(D)	(D)		
36073	ORLEANS			(D)	(D)		
36077	OTSEGO			205	790		
36089	ST. LAWRENCE			53	252		
36091	SARATOGA			(D)	(D)		
36095	SCHOHARIE	(D)	(D)	112	682		
36099	SENECA	(D)	(D)	(D)	(D)		
36101	STEUBEN	(D)	(D)	127	774		
36107	TIOGA			23	88		
36111	ULSTER			(D)	(D)		
36115	WASHINGTON			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
36117	WAYNE	(D)	(D)	(D)	504		
36121	WYOMING			(D)	(D)		
36123	YATES			35	212		
	NORTH CAROLINA						
37001	ALAMANCE	(D)	(D)	192	(D)	3	525
37003	ALEXANDER	(D)	(D)	(D)	(D)		
37005	ALLEGHANY					(D)	(D)
37009	ASHE					(D)	(D)
37013	BEAUFORT	966	64,628				
37015	BERTIE	210	16,420				
37017	BLADEN	1,721	83,582	(D)	(D)		
37019	BRUNSWICK	(D)	(D)				
37021	BUNCOMBE					(D)	(D)
37023	BURKE					(D)	(D)
37025	CABARRUS	(D)	(D)	(D)	(D)		
37031	CARTERET	538	25,735				
37037	CHATHAM	645	32,690	249	2,604		
37041	CHOWAN	797	56,025				
37045	CLEVELAND	58	2,262	(D)	(D)	(D)	(D)
37047	COLUMBUS	1,231	56,277	(D)	(D)		
37049	CRAVEN	932	50,398				
37051	CUMBERLAND	2,461	129,681				
37053	CURRITUCK	176	7,873				
37057	DAVIDSON	(D)	(D)	(D)	(D)	(D)	(D)
37059	DAVIE					(D)	(D)
37061	DUPLIN	3,267	240,824	87	896		
37063	DURHAM	35	3,150				
37065	EDGECOMBE	(D)	(D)				
37069	FRANKLIN	159	11,611	276	3,235		
37071	GASTON			(D)	(D)		
37073	GATES	(D)	(D)				
37077	GRANVILLE	472	20,488				
37079	GREENE	353	23,280				
37081	GUILFORD	219	10,697	(D)	(D)		
37083	HALIFAX	1,706	133,136	(D)	(D)		
37085	HARNETT	2,810	152,579				
37087	HAYWOOD					(D)	(D)

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
37089	HENDERSON					(D)	(D)
37091	HERTFORD	438	29,670				
37095	HYDE	(D)	(D)				
37097	IREDELL	88	3,307	388	4,097		
37101	JOHNSTON	3,937	252,530	96	1,356		
37103	JONES	1,183	63,686				
37105	LEE	693	39,503				
37107	LENOIR	2,203	145,315				
37109	LINCOLN	(D)	(D)	(D)	(D)		
37111	MCDOWELL					(D)	(D)
37117	MARTIN	1,261	82,486				
37123	MONTGOMERY	278	15,550				
37125	MOORE	715	43,329			(D)	(D)
37127	NASH	815	48,483				
37131	NORTHAMPTON	1,027	56,305				
37133	ONSLOW	2,090	113,532			(D)	(D)
37135	ORANGE	132	9,200	(D)	(D)		
37137	PAMLICO	(D)	(D)				
37139	PASQUOTANK	1,193	77,750				
37141	PENDER	634	36,355				
37143	PERQUIMANS	637	51,997				
37145	PERSON	405	30,716				
37147	PITT	2,318	149,900				
37149	POLK	(D)	(D)				
37151	RANDOLPH	358	20,906	(D)	(D)		
37153	RICHMOND	241	8,582			(D)	(D)
37155	ROBESON	2,374	115,007			(D)	(D)
37157	ROCKINGHAM	(D)	(D)	30	360	(D)	(D)
37159	ROWAN	(D)	(D)	397	5,372	(D)	(D)
37161	RUTHERFORD					6	555
37163	SAMPSON	1,462	92,822	507	8,773	(D)	(D)
37165	SCOTLAND	(D)	(D)				
37167	STANLY	(D)	(D)				
37169	STOKES			320	3,520		
37177	TYRRELL	(D)	(D)				
37179	UNION	851	62,155				
37181	VANCE	170	8,103				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
37183	WAKE	1,012	45,246				
37185	WARREN	(D)	(D)	156	2,200		
37187	WASHINGTON	(D)	(D)				
37191	WAYNE	2,243	151,480				
37193	WILKES	(D)	(D)	(D)	(D)	(D)	(D)
37195	WILSON	248	17,543				
37197	YADKIN					(D)	(D)
37199	YANCEY					11	1078
	NORTH DAKOTA						
38025	DUNN			(D)	(D)		
38029	EMMONS			(D)	(D)		
38051	MCINTOSH			(D)	(D)		
38079	ROLETTE			(D)	(D)		
	OHIO						
39001	ADAMS			(D)	(D)		
39003	ALLEN			(D)	(D)		
39005	ASHLAND	(D)	(D)	122	590	(D)	270
39007	ASHTABULA			(D)	(D)		
39013	BELMONT			(D)	(D)		
39015	BROWN	(D)	(D)	(D)	(D)		
39019	CARROLL			(D)	(D)		
39021	CHAMPAIGN	(D)	(D)				
39029	COLUMBIANA			174	1,680		
39031	COSHOCTON			134	1,804	(D)	(D)
39037	DARKE			(D)	(D)		
39039	DEFIANCE			(D)	(D)		
39041	DELAWARE			(D)	(D)		
39043	ERIE			(D)	(D)		
39053	GALLIA			(D)	(D)		
39055	GEAUGA			390	1,524		
39063	HANCOCK			(D)	(D)		
39071	HIGHLAND	(D)	(D)	(D)	(D)		
39075	HOLMES			65	327		
39077	HURON			20	67		
39079	JACKSON	(D)	(D)			(D)	(D)
39083	KNOX	(D)	(D)			(D)	(D)
39087	LAWRENCE			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
39089	LICKING	(D)	(D)				
39091	LOGAN			(D)	(D)		
39093	LORAIN			(D)	(D)		
39099	MAHONING			25	169		
39101	MARION	3	135	(D)	(D)		
39103	MEDINA			(D)	(D)		
39107	MERCER			177	1,720		
39111	MONROE			(D)	(D)		
39113	MONTGOMERY	(D)	(D)				
39115	MORGAN			(D)	(D)		
39117	MORROW			65	660		
39119	MUSKINGUM			(D)	(D)		
39125	PAULDING	(D)	(D)	(D)	(D)		
39127	PERRY			(D)	(D)		
39129	PICKAWAY	(D)	(D)	(D)	(D)		
39133	PORTAGE			(D)	(D)		
39135	PREBLE	(D)	(D)	(D)	(D)		
39137	PUTNAM			(D)	(D)		
39139	RICHLAND			132	1,493		
39141	ROSS	(D)	(D)				
39143	SANDUSKY			(D)	(D)		
39147	SENECA			(D)	(D)		
39149	SHELBY			40	260		
39151	STARK			(D)	(D)		
39155	TRUMBULL			28	325		
39157	TUSCARAWAS			118	1,578		
39159	UNION			(D)	(D)		
39161	VAN WERT			(D)	(D)		
39167	WASHINGTON			(D)	(D)		
39169	WAYNE			162	1,645		
39175	WYANDOT			22	172		
	OKLAHOMA						
40003	ALFALFA	6,865	177,715	(D)	(D)		
40007	BEAVER	22,399	631,184	686	5,515		
40009	BECKHAM	921	19,363	(D)	(D)		
40011	BLAINE	3,487	73,120	(D)	(D)		
40013	BRYAN			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
40015	CADDO	5,760	185,392				
40017	CANADIAN	1,585	29,532	(D)	(D)		
40025	CIMARRON	19,147	526,639	(D)	(D)		
40027	CLEVELAND	210	(D)	(D)	(D)		
40029	COAL			84	825	6	285
40031	COMANCHE	150	3,750				
40033	COTTON	874	29,900	(D)	(D)		
40035	CRAIG	1,915	33,894	(D)	(D)		
40039	CUSTER	2,782	79,560	323	3,376		
40041	DELAWARE	(D)	(D)				
40043	DEWEY	190	2,530				
40045	ELLIS	1,502	50,406	428	2,087		
40047	GARFIELD	21,761	382,396	898	1,408		
40049	GARVIN	191	12,624				
40051	GRADY	4,849	163,302	1,088	8,994		
40053	GRANT	17,163	341,564	(D)	(D)		
40055	GREER	(D)	(D)				
40057	HARMON	136	(D)	(D)	(D)		
40059	HARPER	1,130	20,430	320	2,600		
40063	HUGHES	18	360				
40065	JACKSON	598	20,287	(D)	(D)		
40067	JEFFERSON	(D)	(D)				
40069	JOHNSTON			240	2,100		
40071	KAY	8,494	187,170				
40073	KINGFISHER	953	19,483	590	(D)		
40075	KIOWA	2,442	70,100	389	(D)		
40079	LE FLORE			(D)	(D)		
40081	LINCOLN	150	5,179	(D)	(D)		
40083	LOGAN	2,395	46,827	(D)	(D)		
40085	LOVE	740	4,834				
40087	MCCLAIN	1,022	44,451	(D)	(D)		
40091	MCINTOSH	(D)	(D)				
40093	MAJOR	3,359	79,757				
40095	MARSHALL	(D)	(D)				
40097	MAYES	993	24,384	(D)	(D)		
40099	MURRAY			(D)	(D)		
40101	MUSKOGEE	846	22,674				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
40103	NOBLE	938	10,970				
40105	NOWATA	996	22,866				
40107	OKFUSKEE	(D)	(D)				
40109	OKLAHOMA	(D)	(D)	(D)	(D)		
40111	OKMULGEE	(D)	(D)				
40113	OSAGE	971	25,424	(D)	(D)		
40115	OTTAWA	(D)	(D)	(D)	(D)		
40117	PAWNEE	(D)	(D)				
40119	PAYNE	2,141	46,319				
40121	PITTSBURG	109	10,464				
40123	PONTOTOC	(D)	(D)				
40125	POTTAWATOMIE	397	17,124				
40129	ROGER MILLS	144	3,482	(D)	(D)		
40131	ROGERS	645	23,275	95	1,250		
40139	TEXAS	46,139	1,336,648	(D)	(D)		
40141	TILLMAN	1,764	54,394	321	(D)		
40143	TULSA	(D)	(D)				
40145	WAGONER	565	23,340				
40147	WASHINGTON	240	5,800				
40149	WASHITA	5,834	158,486	391	2,638		
40151	WOODS	725	15,984	(D)	(D)		
40153	WOODWARD	759	23,635				
	OREGON						
41043	LINN			(D)	(D)		
41045	MALHEUR	(D)	(D)				
41047	MARION			(D)	(D)		
	PENNSYLVANIA						
42001	ADAMS	(D)	(D)	492	8,392		
42003	ALLEGHENY			(D)	(D)		
42007	BEAVER			(D)	(D)		
42009	BEDFORD	(D)	(D)	309	3,859		
42011	BERKS	27	1,760	361	3,539		
42013	BLAIR			65	611		
42015	BRADFORD			157	941		
42017	BUCKS	(D)	(D)	254	(D)		
42019	BUTLER			(D)	(D)		
42021	CAMBRIA			4	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
42027	CENTRE			286	1,270		
42029	CHESTER	(D)	(D)	34	(D)		
42031	CLARION	(D)	(D)				
42033	CLEARFIELD			30	96		
42035	CLINTON			39	182		
42037	COLUMBIA	58	2,169	74	207		
42039	CRAWFORD			70	160		
42041	CUMBERLAND	125	8,294	524	4,401		
42043	DAUPHIN			66	(D)		
42049	ERIE			(D)	(D)		
42051	FAYETTE			(D)	(D)		
42055	FRANKLIN	371	33,800	2,440	31,551		
42057	FULTON	96	6,020	462	5,416		
42061	HUNTINGDON	(D)	(D)	532	5,093		
42063	INDIANA			42	(D)		
42065	JEFFERSON			15	(D)		
42067	JUNIATA	(D)	(D)	319	2,323		
42069	LACKAWANNA	(D)	(D)	(D)	(D)		
42071	LANCASTER	132	10,809	443	4,006		
42073	LAWRENCE	(D)	(D)	51	808		
42075	LEBANON	18	1,340	244	1,910		
42077	LEHIGH	21	900	(D)	(D)		
42081	LYCOMING	(D)	(D)	33	254		
42085	MERCER			85	259		
42087	MIFFLIN			60	279		
42091	MONTGOMERY			(D)	(D)		
42093	MONTOUR			142	1,149		
42095	NORTHAMPTON	(D)	(D)	(D)	(D)		
42097	NORTHUMBERLAND	332	41,709	55	667		
42099	PERRY	(D)	(D)	49	312		
42105	POTTER	(D)	(D)	(D)	(D)		
42107	SCHUYLKILL	29	1,420	73	516		
42109	SNYDER			37	500		
42111	SOMERSET			76	558		
42115	SUSQUEHANNA			(D)	(D)		
42117	TIOGA	(D)	(D)	116	401		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
42119	UNION	(D)	(D)	100	588		
42121	VENANGO	(D)	(D)				
42123	WARREN			15	135		
42125	WASHINGTON	152	7,400	(D)	(D)		
42127	WAYNE			46	(D)		
42129	WESTMORELAND			155	2,480		
42131	WYOMING			13	110		
42133	YORK			(D)	(D)		
	SOUTH CAROLINA						
45001	ABBEVILLE	(D)	(D)	(D)	(D)		
45003	AIKEN	678	30,760				
45005	ALLENDALE	(D)	(D)				
45007	ANDERSON	757	32,670	(D)	(D)		
45009	BAMBERG	(D)	19,700	(D)	(D)		
45013	BEAUFORT			(D)	(D)		
45015	BERKELEY	(D)	(D)				
45017	CALHOUN	112	10,024				
45019	CHARLESTON	41	902				
45023	CHESTER	(D)	(D)	(D)	(D)		
45025	CHESTERFIELD	(D)	(D)				
45027	CLARENDON	661	32,303				
45031	DARLINGTON	2,656	124,484	(D)	(D)		
45033	DILLON	776	21,944				
45041	FLORENCE	579	30,300	522	2,920		
45043	GEORGETOWN	(D)	(D)				
45045	GREENVILLE	(D)	(D)				
45049	HAMPTON	(D)	(D)				
45051	HORRY	589	14,666				
45053	JASPER	(D)	(D)				
45055	KERSHAW	(D)	(D)				
45057	LANCASTER	(D)	(D)				
45059	LAURENS			(D)	(D)		
45061	LEE	1,276	73,209				
45063	LEXINGTON	564	23,346	(D)	(D)		
45067	MARION	465	44,453	(D)	(D)		
45069	MARLBORO	261	11,484				
45071	NEWBERRY	179	5,028	3,560	48,238		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
45075	ORANGEBURG	434	24,200	390	5,130		
45077	PICKENS			(D)	(D)		
45079	RICHLAND	284	13,428	(D)	(D)		
45081	SALUDA	(D)	(D)	(D)	(D)	(D)	(D)
45083	SPARTANBURG	(D)	(D)	290	3,530		
45085	SUMTER	(D)	(D)	(D)	(D)		
45087	UNION	(D)	(D)	(D)	(D)		
45089	WILLIAMSBURG	382	13,164	204	(D)		
45091	YORK	(D)	(D)				
	SOUTH DAKOTA						
46003	AURORA	1,651	122,236	360	3,027		
46005	BEADLE	200	9,868	457	(D)		
46007	BENNETT	850	22,426	287	2,414		
46009	BON HOMME			178	1,016		
46011	BROOKINGS	(D)	(D)				
46013	BROWN	(D)	(D)				
46015	BRULE	1,160	63,916	801	6,626		
46017	BUFFALO	(D)	(D)	(D)	(D)		
46019	BUTTE	50	1,954	(D)	(D)		
46023	CHARLES MIX	1,407	74,941	714	11,641		
46031	CORSON			680	8,857		
46033	CUSTER	2,400	74,556				
46035	DAVISON	313	10,365				
46041	DEWEY	(D)	(D)				
46043	DOUGLAS			(D)	(D)		
46047	FALL RIVER	(D)	(D)	1,099	(D)		
46051	GRANT			(D)	(D)		
46053	GREGORY	2,278	91,616	418	2,126		
46055	HAAKON	6,409	186,150	1,196	8,734		
46059	HAND	3,798	129,908	468	4,977		
46061	HANSON	(D)	(D)				
46065	HUGHES	3,092	134,513	220	1,478		
46069	HYDE	701	28,000	(D)	(D)		
46071	JACKSON	(D)	(D)				
46073	JERAULD	2,340	114,450	1,222	10,116		
46075	JONES	13,092	569,881	554	4,770		
46077	KINGSBURY	(D)	(D)	176	1,551		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
46085	LYMAN	60,012	2,446,036	193	1,559		
46091	MARSHALL			(D)	(D)		
46093	MEADE	354	17,323	(D)	(D)		
46095	MELLETTE	3,249	114,795	(D)	(D)		
46097	MINER	(D)	(D)	(D)	(D)		
46105	PERKINS	(D)	(D)	(D)	(D)		
46107	POTTER	(D)	(D)	(D)	(D)		
46111	SANBORN	468	19,248	1,197	12,803		
46115	SPINK	938	55,793	339	3,590		
46117	STANLEY	9,227	391,725	(D)	(D)		
46119	SULLY	876	51,165	(D)	(D)		
46121	TODD			326	2,562		
46123	TRIPP	20,371	1,012,930	2,884	28,998		
46129	WALWORTH	(D)	(D)				
46135	YANKTON			46	659		
46137	ZIEBACH	(D)	(D)				
	TENNESSEE						
47001	ANDERSON					(D)	(D)
47003	BEDFORD	(D)	(D)	(D)	(D)		
47007	BLEDSOE			(D)	(D)		
47009	BLOUNT			(D)	(D)		
47011	BRADLEY			(D)	(D)		
47013	CAMPBELL					(D)	(D)
47015	CANNON					(D)	(D)
47017	CARROLL	(D)	(D)			(D)	(D)
47021	CHEATHAM	(D)	(D)				
47025	CLAIBORNE					(D)	(D)
47027	CLAY					(D)	(D)
47031	COFFEE					(D)	(D)
47039	DECATUR	(D)	(D)			(D)	(D)
47043	DICKSON					7	746
47045	DYER	4,480	320,638				
47047	FAYETTE	549	40,767				
47051	FRANKLIN					(D)	(D)
47053	GIBSON	(D)	(D)	(D)	(D)		
47055	GILES	(D)	(D)			(D)	(D)
47065	HAMILTON					(D)	(D)

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
47067	HANCOCK					(D)	(D)
47069	HARDEMAN	679	53,159				
47071	HARDIN	520	50,622				
47073	HAWKINS					(D)	(D)
47075	HAYWOOD	386	24,215				
47077	HENDERSON	(D)	(D)			(D)	(D)
47079	HENRY			(D)	(D)		
47081	HICKMAN					(D)	(D)
47089	JEFFERSON	(D)	(D)				
47091	JOHNSON					(D)	(D)
47095	LAKE	738	63,464				
47097	LAUDERDALE	(D)	(D)				
47099	LAWRENCE	(D)	(D)			9	870
47103	LINCOLN			(D)	(D)		
47109	MCNAIRY	(D)	(D)				
47113	MADISON	(D)	(D)				
47117	MARSHALL			(D)	(D)		
47119	MAURY	(D)	(D)	(D)	(D)		
47123	MONROE			203	2,600		
47125	MONTGOMERY	(D)	(D)			(D)	(D)
47131	OBION	682	48,380				
47133	OVERTON	(D)	(D)			75	15716
47135	PERRY					(D)	(D)
47139	POLK					4	799
47141	PUTNAM					(D)	(D)
47143	RHEA			(D)	(D)		
47147	ROBERTSON	(D)	(D)	(D)	(D)		
47149	RUTHERFORD	(D)	(D)			(D)	(D)
47157	SHELBY	(D)	(D)				
47167	TIPTON	267	18,226				
47169	TROUSDALE			(D)	(D)		
47177	WARREN	(D)	(D)			(D)	(D)
47183	WEAKLEY	362	25,423				
47185	WHITE			(D)	(D)		
47187	WILLIAMSON			(D)	(D)		
TEXAS							
48001	ANDERSON	(D)	(D)	167	637		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
48003	ANDREWS	3,856	167,798	255	1,698		
48009	ARCHER	524	16,488	(D)	(D)		
48011	ARMSTRONG	13,021	337,980	644	7,571		
48013	ATASCOSA	2,457	130,084	(D)	(D)	(D)	(D)
48015	AUSTIN	2,373	193,490	103	333		
48017	BAILEY	23,479	1,288,404	7,887	104,027		
48021	BASTROP	1,179	88,118	186	(D)		
48023	BAYLOR	126	4,507	(D)	(D)		
48025	BEE	10,470	596,037				
48027	BELL	21,938	1,813,821				
48029	BEXAR	3,888	196,090				
48031	BLANCO			(D)	(D)		
48033	BORDEN	(D)	(D)				
48035	BOSQUE	1,757	118,315	1,046	10,778		
48037	BOWIE	466	25,318				
48039	BRAZORIA	17,644	1,508,197				
48041	BRAZOS	1,461	137,146				
48043	BREWSTER	(D)	(D)				
48045	BRISCOE	3,372	86,816	(D)	(D)		
48047	BROOKS			580	8,122		
48049	BROWN	(D)	(D)	960	(D)		
48051	BURLESON	2,842	208,383				
48055	CALDWELL	4,993	373,036				
48057	CALHOUN	19,307	1,705,194				
48059	CALLAHAN	307	8,130	(D)	(D)		
48061	CAMERON	91,549	6,335,563	289	4,423		
48065	CARSON	15,995	700,138				
48067	CASS			(D)	(D)		
48069	CASTRO	19,788	1,067,789	10,401	168,043		
48071	CHAMBERS	1,810	55,926				
48075	CHILDRESS	(D)	(D)	220	1,088		
48079	COCHRAN	5,599	218,235	(D)	(D)		
48081	COKE	(D)	(D)	(D)	(D)		
48083	COLEMAN	5,136	243,899	90	182		
48085	COLLIN	15,535	879,707	56	600		
48087	COLLINGSWORTH	1,613	(D)	(D)	(D)		
48089	COLORADO	486	(D)				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
48091	COMAL	(D)	(D)	(D)	(D)		
48093	COMANCHE	681	(D)	3,024	33,354		
48095	CONCHO	9,254	320,463				
48097	COOKE	6,642	341,377	378	2,028		
48099	CORYELL	4,378	351,597	(D)	(D)		
48101	COTTLE	(D)	(D)	(D)	(D)		
48107	CROSBY	8,272	301,987				
48111	DALLAM	13,544	770,732	3,340	(D)		
48113	DALLAS			(D)	(D)		
48115	DAWSON	5,779	209,083	(D)	(D)		
48117	DEAF SMITH	30,491	1,379,623	15,114	207,571		
48119	DELTA	2,928	223,483				
48121	DENTON	7,329	330,244	2,153	20,742		
48123	DEWITT	1,055	36,952				
48125	DICKENS	1,224	57,402				
48127	DIMMIT	567	47,231				
48129	DONLEY	890	20,441	334	4,650		
48133	EASTLAND	(D)	(D)	(D)	(D)		
48139	ELLIS	20,262	1,645,576				
48141	EL PASO	(D)	(D)	(D)	(D)		
48143	ERATH	1,207	81,321	5,198	38,071		
48145	FALLS	8,139	691,090	(D)	(D)		
48147	FANNIN	5,974	412,505	(D)	(D)		
48149	FAYETTE	537	43,578				
48151	FISHER	462	50,134				
48153	FLOYD	10,364	565,405	(D)	(D)		
48157	FORT BEND	28,637	2,854,693				
48159	FRANKLIN	(D)	(D)	(D)	(D)		
48163	FRIO	5,267	262,777	(D)	(D)		
48165	GAINES	18,579	670,898				
48167	GALVESTON	(D)	(D)	(D)	(D)		
48169	GARZA			(D)	(D)		
48171	GILLESPIE	981	40,299	44	55		
48173	GLASSCOCK	(D)	(D)	(D)	(D)		
48175	GOLIAD	1,810	99,876				
48177	GONZALES	1,475	141,554				
48179	GRAY	4,518	178,067	1,900	29,758		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
48181	GRAYSON	6,548	502,915	(D)	(D)		
48185	GRIMES	579	(D)				
48187	GUADALUPE	16,329	1,146,854	432	1,425		
48189	HALE	27,395	1,820,675	1,618	26,985		
48191	HALL	(D)	(D)	(D)	(D)		
48193	HAMILTON	3,067	224,707	901	7,777		
48195	HANSFORD	7,091	521,102	(D)	(D)		
48197	HARDEMAN	(D)	(D)	(D)	(D)		
48201	HARRIS	545	54,869				
48205	HARTLEY	21,270	1,620,831	3,331	43,180		
48207	HASKELL	11,289	859,666				
48209	HAYS	855	63,483				
48215	HIDALGO	170,770	10,573,463	490	970		
48217	HILL	25,920	2,297,903	(D)	(D)		
48219	HOCKLEY	19,654	600,426	527	217		
48221	HOOD	89	3,957	(D)	(D)		
48223	HOPKINS	1,300	69,919	1,140	15,073		
48225	HOUSTON	282	16,650	3	9		
48231	HUNT	9,834	716,069				
48233	HUTCHINSON	3,419	343,731	755	13,275		
48239	JACKSON	8,226	624,737				
48245	JEFFERSON	(D)	(D)				
48249	JIM WELLS	62,649	2,115,481	(D)	(D)		
48251	JOHNSON	8,844	701,300	720	(D)		
48253	JONES	4,643	308,538				
48255	KARNES	5,868	280,867	(D)	(D)		
48257	KAUFMAN	1,350	78,286				
48259	KENDALL			(D)	(D)		
48267	KIMBLE	(D)	(D)	(D)	(D)		
48273	KLEBERG	35,870	1,334,317				
48275	KNOX	189	5,654				
48277	LAMAR	6,794	514,133	(D)	(D)		
48279	LAMB	26,616	1,222,856	6,004	89,073		
48281	LAMPASAS			(D)	(D)		
48283	LA SALLE	6,200	189,478				
48285	LAVACA	324	16,592				
48287	LEE	102	6,263				

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
48291	LIBERTY	3,698	335,471				
48293	LIMESTONE	1,708	162,739				
48295	LIPSCOMB	4,460	258,986				
48297	LIVE OAK	1,613	65,467				
48299	LLANO	(D)	(D)				
48303	LUBBOCK	28,614	1,077,242	868	6,222		
48305	LYNN	11,616	387,342	415	(D)		
48307	MCCULLOCH	(D)	(D)				
48309	MCLENNAN	13,096	1,007,355	661	8,818		
48313	MADISON	(D)	(D)	(D)	(D)		
48319	MASON	(D)	(D)				
48321	MATAGORDA	31,264	2,791,416				
48323	MAVERICK	(D)	(D)	(D)	(D)		
48325	MEDINA	8,372	423,194	(D)	(D)		
48327	MENARD	(D)	(D)				
48329	MIDLAND	(D)	(D)				
48331	MILAM	13,411	933,633				
48333	MILLS	592	15,236	161	216		
48335	MITCHELL	(D)	(D)				
48337	MONTAGUE	50	3,118				
48339	MONTGOMERY			(D)	(D)		
48341	MOORE	44,617	3,475,653	508	8,559		
48349	NAVARRO	12,244	949,224				
48351	NEWTON	(D)	(D)				
48353	NOLAN	717	32,063	(D)	(D)		
48355	NUECES	147,425	6,651,268	(D)	(D)		
48357	OCHILTREE	20,527	1,151,788	(D)	(D)		
48359	OLDHAM	4,995	131,926	424	(D)		
48363	PALO PINTO	(D)	(D)	(D)	(D)		
48365	PANOLA	(D)	(D)				
48367	PARKER	(D)	(D)				
48369	PARMER	17,652	926,123	14,342	222,531		
48371	PECOS	(D)	(D)				
48375	POTTER	879	25,005	(D)	(D)		
48381	RANDALL	13,573	464,386	2,024	20,557		
48383	REAGAN	204	7,430				
48385	REAL			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
48387	RED RIVER	2,557	(D)				
48389	REEVES			141	2,100		
48391	REFUGIO	41,025	2,702,320				
48393	ROBERTS	1,337	49,072	(D)	(D)		
48395	ROBERTSON	5,153	438,287				
48397	ROCKWALL	(D)	(D)	(D)	(D)		
48399	RUNNELS	5,014	210,312				
48409	SAN PATRICIO	96,311	5,352,054				
48413	SCHLEICHER	202	9,571	(D)	(D)		
48415	SCURRY	568	23,032	(D)	8,110		
48419	SHELBY	890	40,564				
48421	SHERMAN	17,410	1,186,601	888	15,569		
48427	STARR	32,675	2,233,383				
48435	SUTTON	(D)	(D)				
48437	SWISHER	8,810	509,887	1,096	21,092		
48439	TARRANT	2,320	121,860				
48441	TAYLOR	744	36,085				
48445	TERRY	25,410	872,439	1,807	8,154		
48447	THROCKMORTON	(D)	(D)	(D)	(D)		
48451	TOM GREEN	17,739	739,805	390	5,367		
48453	TRAVIS	14,211	1,003,560	(D)	(D)		
48459	UPSHUR			(D)	(D)		
48461	UPTON	(D)	(D)				
48463	UVALDE	13,678	679,626				
48469	VICTORIA	15,403	1,325,277				
48473	WALLER	1,085	52,842				
48477	WASHINGTON	170	12,214	180	540		
48479	WEBB	(D)	(D)				
48481	WHARTON	45,515	4,042,018	(D)	(D)		
48483	WHEELER	(D)	(D)	(D)	(D)		
48485	WICHITA	470	23,502	(D)	(D)		
48487	WILBARGER	1,379	34,951				
48489	WILLACY	125,297	8,777,437				
48491	WILLIAMSON	23,464	1,725,341	26	170		
48493	WILSON	6,822	447,069	583	715	(D)	(D)
48497	WISE	1,745	54,066				
48499	WOOD			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
48501	YOAKUM	4,099	217,154				
48503	YOUNG	(D)	(D)				
48507	ZAVALA	5,806	315,100	(D)	(D)		
	UTAH						
49005	CACHE			75	615		
49015	EMERY	(D)	(D)				
49023	JUAB			(D)	(D)		
49027	MILLARD			(D)	(D)		
49039	SANPETE			(D)	(D)		
49057	WEBER			(D)	(D)		
	VERMONT						
50003	BENNINGTON					(D)	(D)
50007	CHITTENDEN			(D)	(D)		
50021	RUTLAND			(D)	(D)		
	VIRGINIA						
51001	ACCOMACK	(D)	(D)				
51003	ALBEMARLE	142	4,727	(D)	(D)		
51007	AMELIA	44	2,200				
51011	APPOMATTOX	(D)	(D)	54	300		
51015	AUGUSTA	96	8,620	268	3,213		
51017	BATH			(D)	(D)		
51019	BEDFORD			428	6,000		
51025	BRUNSWICK	282	20,230				
51029	BUCKINGHAM			(D)	(D)		
51031	CAMPBELL	(D)	(D)	(D)	(D)		
51033	CAROLINE	(D)	(D)				
51036	CHARLES CITY	(D)	(D)				
51037	CHARLOTTE	(D)	(D)	(D)	(D)	(D)	(D)
51041	CHESTERFIELD	(D)	(D)				
51047	CULPEPER			(D)	(D)		
51049	CUMBERLAND	15	450	(D)	(D)		
51053	DINWIDDIE	(D)	(D)				
51061	FAUQUIER	(D)	(D)	340	4,550		
51063	FLOYD	(D)	(D)	(D)	(D)		
51067	FRANKLIN	(D)	(D)	597	6,245		
51069	FREDERICK			100	1,230		
51075	GOOCHLAND			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
51081	GREENSVILLE	(D)	(D)				
51083	HALIFAX	63	2,750				
51085	HANOVER	(D)	(D)				
51087	HENRICO	(D)	(D)				
51089	HENRY			(D)	(D)		
51093	ISLE OF WIGHT	72	3,820				
51107	LOUDOUN	(D)	(D)	(D)	(D)		
51109	LOUISA	(D)	(D)	(D)	(D)		
51111	LUNENBURG	60	3,300				
51113	MADISON			(D)	(D)		
51117	MECKLENBURG	63	3,825	(D)	(D)		
51133	NORTHUMBERLAND	(D)	(D)				
51135	NOTTOWAY	300	25,500				
51139	PAGE			52	520		
51141	PATRICK	(D)	(D)				
51143	PITTSYLVANIA	155	8,650				
51147	PRINCE EDWARD	(D)	(D)	(D)	(D)		
51149	PRINCE GEORGE	(D)	(D)				
51153	PRINCE WILLIAM			(D)	(D)		
51159	RICHMOND	(D)	(D)				
51163	ROCKBRIDGE			138	1,805		
51165	ROCKINGHAM	(D)	(D)	993	15,750	7	519
51169	SCOTT	36	1,988			(D)	(D)
51171	SHENANDOAH	(D)	(D)	(D)	(D)		
51173	SMYTH			(D)	(D)	(D)	(D)
51175	SOUTHAMPTON	338	16,633				
51177	SPOTSYLVANIA			(D)	(D)		
51181	SURRY	276	22,797				
51183	SUSSEX	(D)	(D)				
51193	WESTMORELAND	(D)	(D)	(D)	(D)		
51197	WYTHE			(D)	(D)		
	WASHINGTON						
53063	SPOKANE	(D)	(D)				
53073	WHATCOM	(D)	(D)				
	WEST VIRGINIA						
54003	BERKELEY			216	2,902		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
54013	CALHOUN	(D)	(D)				
54023	GRANT			58	828		
54031	HARDY	123	8,665	110	1,606		
54033	HARRISON			(D)	(D)		
54037	JEFFERSON	274	16,445	166	2,164		
54051	MARSHALL					(D)	(D)
54053	MASON					(D)	(D)
54057	MINERAL			(D)	(D)		
54063	MONROE	(D)	(D)	(D)	(D)		
54067	NICHOLAS					(D)	(D)
54069	OHIO	30	600				
54085	RITCHIE	(D)	(D)				
54089	SUMMERS					3	150
	WISCONSIN						
55007	BAYFIELD			36	360		
55009	BROWN	100	5,610	106	743		
55015	CALUMET			115	294		
55017	CHIPPEWA			86	1,102		
55019	CLARK	(D)	(D)	92	896	(D)	(D)
55021	COLUMBIA			(D)	(D)		
55023	CRAWFORD			(D)	(D)		
55025	DANE	(D)	(D)	305	2,551		
55027	DODGE			38	152		
55029	DOOR			104	1,451		
55033	DUNN			(D)	(D)		
55035	EAU CLAIRE	114	2,850	56	890		
55037	FLORENCE			(D)	(D)		
55039	FOND DU LAC	(D)	(D)	241	2,249		
55043	GRANT	(D)	(D)	125	797		
55045	GREEN			173	(D)		
55049	IOWA			(D)	(D)		
55053	JACKSON	(D)	(D)	(D)	(D)		
55055	JEFFERSON			162	2,725		
55057	JUNEAU	25	1,150	48	245		
55059	KENOSHA			27	108		
55061	KEWAUNEE	(D)	(D)	688	2,440		
55065	LAFAYETTE			(D)	(D)		

FIPS	County	Grain Sorghum		Silage Sorghum		Syrup Sorghum	
		Acres Harvested	Production in Bushels	Acres Harvested	Production in Tons	Acres Harvested	Production in Gallons
55067	LANGLADE			(D)	(D)		
55071	MANITOWOC	(D)	(D)	365	4,911		
55073	MARATHON			259	1,439		
55075	MARINETTE			162	643		
55077	MARQUETTE			(D)	(D)		
55079	MILWAUKEE			60	360		
55081	MONROE			12	110		
55083	OCONTO	(D)	(D)	29	434		
55085	ONEIDA			20	60		
55087	OUTAGAMIE	(D)	(D)	217	6,487		
55089	OZAUKEE			(D)	(D)		
55091	PEPIN	(D)	(D)			(D)	(D)
55093	PIERCE	(D)	(D)	(D)	(D)		
55095	POLK			(D)	(D)		
55097	PORTAGE			(D)	(D)		
55101	RACINE			65	194		
55103	RICHLAND			(D)	(D)	(D)	152
55105	ROCK			(D)	(D)		
55109	ST. CROIX	(D)	(D)				
55111	SAUK			164	837		
55113	SAWYER			(D)	(D)		
55115	SHAWANO	110	4,580	80	(D)		
55117	SHEBOYGAN	(D)	(D)	289	1,480	(D)	(D)
55121	TREMPEALEAU			(D)	(D)		
55123	VERNON	(D)	(D)	210	1,379	5	(D)
55127	WALWORTH			(D)	(D)		
55131	WASHINGTON			143	758		
55135	WAUPACA			(D)	(D)		
55137	WAUSHARA			(D)	(D)		
55139	WINNEBAGO			626	7,304		
55141	WOOD			47	167		
	WYOMING						
56021	LARAMIE	(D)	(D)	(D)	(D)		
56031	PLATTE			(D)	(D)		

Appendix C

U.S. Biofuel Support Programs Status

Table C1. U.S. Biofuel Support Programs Status

Administering Agency	Program	Authorizing Legislation	Status
Internal Revenue Service	Volumetric Ethanol Excise Tax Credit	Public Law 108-357 Section 301	Expired 2011
Internal Revenue Service	Small Ethanol Producer Credit	Public Law 101-508	Expired 2011
Internal Revenue Service	Biodiesel Tax Credit	Public Law 108-357	Expired 2011
Internal Revenue Service	Small Agri-biodiesel Producer Credit	Public Law 109-58	Expired 2011
Internal Revenue Service	Renewable Diesel Tax Credit	Public Law 109-58	Expired 2011
Internal Revenue Service	Alternative Fueling Station Credit	Public Law 109-58 Section 1342	Expired 2011
U.S. Customs and Border Protection	Import Duty for Fuel Ethanol	Public Law 96-499	Expired 2011
Internal Revenue Service	Special Depreciation Allowance for Cellulosic Biofuel Plant Property	Public Law 109-432	Expired 2012
Department of Agriculture	Biorefinery Assistance	Public Law 110-246 Section 9001	Expired 2012
Department of Agriculture	Repowering Assistance	Public Law 110-246 Section 9001	Expired 2012
Department of Agriculture	Bioenergy Program for Advanced Biofuels	Public Law 110-246 Section 9001	Expired 2012
Department of Agriculture	Biomass Crop Assistance Program (BCAP)	Public Law 110-246 Section 9001	Expired 2012
Department of Agriculture	Rural Energy for America Program (REAP)	Public Law 110-246 Section 9001	Expired 2012
Internal Revenue Service	Credit for Production of Cellulosic Biofuel	Public Law 110-246	Expired 2013
Department of Energy	Cellulosic Ethanol Reserve Auction	Public Law 109-58 Section 942	Scheduled to end 2015
Department of Agriculture	Biomass Research and Development	Public Law 106-224; Public Law 113-79, Section 9005	Expires 2019
Department of Agriculture	Bioenergy Program for Advanced Biofuels	Public Law 113-79, Title IX, Section 9005	Expires 2019
Department of Transportation	Flexible Fuel Vehicle Production Incentive	Public Law 94-163	Expires 2019
Department of Agriculture	Bioenergy Program for Advanced Biofuels	Public Law 113-79, Section 9005	Expires 2019
Department of Agriculture	Biorefinery Assistance	Public Law 113-79, Section 9003	Expires 2019
Department of Agriculture	Rural Energy for America	Public Law 113-79, Section 9007	Expires 2019
Department of Energy	Loan Guarantees for Ethanol and Commercial Byproducts from Various Feedstocks	Public Law 109-58 Sections 1510, 1511, and 1516	Varies including ongoing guarantees; new guarantees require funding authorization
Department of Agriculture	Feedstock Flexibility Program for Producers of Biofuels (Sugar)	Public Law 110-246 Section 9001	Ongoing
Environmental Protection Agency	Renewable Fuel Standard Mandated use of renewable fuel	Public Law 109-58 Section 1501	Ongoing

Administering Agency	Program	Authorizing Legislation	Status
	in gasoline:		
Department of Energy	Biorefinery Project Grants	Various statutes	Ongoing
Department of Energy	DOE Loan Guarantee Program	Public Law 109-58 Title XVII	Ongoing

Source: After Yacobucci, B.D., 2012, Biofuels Incentives: A Summary of Federal Programs, https://www.fas.org/sgp/crs/misc/R40110.pdf, accessed February, 2015; updated by the Contractor's Research Department.

Appendix D

Federal and State Bioenergy Laws and Incentives

Table D1. Federal Law and Incentives

Incentives	Laws and Regulations	Programs
Advanced Biofuel Feedstock Incentives	Aftermarket Alternative Fuel Vehicle (AFV) Conversions	Air Pollution Control Program
Advanced Biofuel Production Grants and Loan Guarantees	Alternative Fuel Definition	Clean Agriculture USA
Advanced Biofuel Production Payments	Alternative Fuel Definition - Internal Revenue Code	Clean Cities
Advanced Energy Research Project Grants	Alternative Fuel Excise Tax	Clean Construction USA
Advanced Technology Vehicle (ATV) Manufacturing Incentives	Alternative Fuel Labeling Requirements	Clean Ports USA
Airport Zero Emission Vehicle (ZEV) and Infrastructure Incentives	Fuel Economy Test Procedures and Labeling	Clean School Bus USA
Alternative Fuel Excise Tax Credit	Greenhouse Gas (GHG) Reporting Requirement	Congestion Mitigation and Air Quality (CMAQ) Improvement Program
Alternative Fuel Infrastructure Tax Credit	High Occupancy Vehicle (HOV) Lane Exemption	National Clean Diesel Campaign (NCDC)
Alternative Fuel Mixture Excise Tax Credit	Idle Reduction Technology Weight Exemption	Pollution Prevention Grants Program
Alternative Fuel Tax Exemption	Procurement Preference for Electric and Hybrid Electric Vehicles	Propane Education, Research, and Training
Alternative Fuel and Advanced Vehicle Technology Research and Demonstration Bonds	Renewable Fuel Standard (RFS) Program	SmartWay Transport Partnership
Biobased Transportation Research Funding	Tier 2 and Tier 3 Vehicle and Gasoline Sulfur Program	State Energy Program (SEP) Funding
Biodiesel Education Grants	Vehicle Acquisition and Fuel Use Requirements for Federal Fleets	Voluntary Airport Low Emission (VALE) Program
Biodiesel Income Tax Credit	Vehicle Acquisition and Fuel Use Requirements for Private and Local Government Fleets	
Biodiesel Mixture Excise Tax Credit	Vehicle Acquisition and Fuel Use Requirements for State and Alternative Fuel Provider Fleets	
Biomass Research and Development Initiative	Vehicle Fuel Economy and Greenhouse Gas Emissions Standards	
Ethanol Infrastructure Grants and Loan Guarantees	Vehicle Incremental Cost Allocation	
Fuel Cell Motor Vehicle Tax Credit		
Hydrogen Fuel Excise Tax Credit		
Hydrogen Fuel Infrastructure Tax Credit		
Hydrogen Fuel Mixture Excise Tax Credit		
Idle Reduction Equipment Excise Tax Exemption		
Improved Energy Technology Loans		
Low- and Zero-Emission Vehicle Research, Demonstration, and Deployment Funding		
Qualified Plug-In Electric Drive Motor Vehicle Tax Credit		
Second Generation Biofuel Production Property		

Incentives	Laws and Regulations	Programs
Depreciation Allowance		
Second Generation Producer Tax Credit		
Value-Added Producer Grants (VAPG)		

Source: Department of Energy, Energy Efficiency & Renewable Energy, Alternative Fuels Data Center
http://www.afdc.energy.gov/laws/fed_summary

Table D2. Ethanol Law and Incentives

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5197	AK	Alternative Fuel Vehicle Acquisition Requirement	Laws and Regulations				http://www.legis.state.ak.us/folhome.htm
6403	AK	Ethanol Fuel Blend Tax Rate	Laws and Regulations				http://www.legis.state.ak.us/folhome.htm
6253	AL	Alternative Fuels Promotion and Information	Laws and Regulations				http://alisondb.legislature.state.al.us/acas/ACASLogin.asp
6545	AL	Biofuel Production Facility Tax Credit	State Incentives			TAX	http://alisondb.legislature.state.al.us/acas/ACASLoginfire.asp
6546	AL	Fuel-Efficient Green Fleets Policy and Fleet Management Program Development	Laws and Regulations				http://alisondb.legislature.state.al.us/acas/ACASLoginfire.asp|http://governor.alabama.gov/news/newsroom.aspx?t=29
9218	AR	Alternative Fuel Definition and Specifications	Laws and Regulations				http://www.arkleg.state.ar.us/
5817	AR	Alternative Fuel Vehicle Conversion	Laws and Regulations				http://www.arkleg.state.ar.us/
5815	AR	Alternative Fuels Tax and Reporting	Laws and Regulations				http://www.arkleg.state.ar.us/
11579	AR	Personal Use Biofuel Reporting	Laws and Regulations				http://www.arkleg.state.ar.us
8384	AZ	Biofuels Definitions and Specifications	Laws and Regulations				http://www.azleg.gov/ArizonaRevisedStatutes.asp
8402	AZ	Federal Fleet Operation Regulations	Laws and Regulations				http://www.azleg.state.az.us/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8400	AZ	Municipal Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.azleg.state.az.us/
8401	AZ	School District Alternative Fuel Vehicle Acquisition Requirements	Laws and Regulations				http://www.azleg.state.az.us/
5188	AZ	State Vehicle Acquisition and Fuel Use Requirements	Laws and Regulations				http://azmemory.azlibrary.gov/cdm/singleitem/collection/execorders/id/700|http://www.azleg.gov/ArizonaRevisedStatutes.asp
6490	CA	Alternative Fuel and Plug-in Hybrid Electric Vehicle Retrofit Regulations	Laws and Regulations				http://www.oal.ca.gov/
6307	CA	Alternative Fuel and Vehicle Incentives	State Incentives			GNT|LOANS	http://www.oal.ca.gov/|http://www.legislature.ca.gov/
5681	CA	Alternative Fuel and Vehicle Policy Development	Laws and Regulations				http://www.oal.ca.gov/|http://www.legislature.ca.gov/
4246	CA	Alternative Fuel Tax	Laws and Regulations				http://www.oal.ca.gov/|http://www.oal.ca.gov/|http://www.legislature.ca.gov/
10393	CA	Alternative Fuel Vehicle (AFV) Parking Incentive Programs	Laws and Regulations				http://www.oal.ca.gov/
9395	CA	Biofuel Volume Rebate Program - Propel Fuels	Utility/Private Incentives			RBATE	

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
4219	CA	Employer Invested Emissions Reduction Funding - South Coast	State Incentives			GNT	
6308	CA	Low Carbon Fuel Standard	Laws and Regulations				http://gov.ca.gov/s_executiveorders.php|http://www.oal.ca.gov/
6493	CA	Low Emission Vehicle (LEV) Standards	Laws and Regulations				http://www.oal.ca.gov/
6134	CA	Low Emission Vehicle Incentives and Technical Training - San Joaquin Valley	State Incentives			GNT|OTHER|RBATE	
6619	CA	State Transportation Plan	Laws and Regulations				http://www.oal.ca.gov/
11160	CA	Support for Advance Biofuel Development	Laws and Regulations				http://www.oal.ca.gov/
6492	CA	Vehicle Acquisition and Petroleum Reduction Requirements	Laws and Regulations				http://www.documents.dgs.ca.gov/ofa/eos-14-09.pdf|http://www.oal.ca.gov/|http://leginfo.legislature.ca.gov/faces/billSearchClient.xhtml
6289	CO	Alternative Fuel Definition	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
11565	CO	Alternative Fuel Vehicle (AFV) Fleet Technical Assistance	State Incentives			OTHER	
5887	CO	Alternative Fuel Vehicle (AFV) Registration	Laws and Regulations				http://www.lexisnexis.com/hottopics/Colorado/
6290	CO	Biofuels Research Grants	State Incentives			GNT	http://www.lexisnexis.com/hottopics/michie/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8740	CO	Ethanol Infrastructure Grants	State Incentives			GNT	
4274	CO	Gasoline and Diesel Gallon Equivalent Definition	Laws and Regulations				http://www.lexisnexis.com/hottopics/Colorado/
6293	CO	Renewable and Alternative Fuel Storage Tank Regulations	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/|http://www.sos.state.co.us/CCR/Welcome.do
5619	CO	State Agency Alternative Fuel Use and Vehicle Acquisition Requirement	Laws and Regulations				http://www.colorado.gov/cs/Satellite/GovRitter/GOVR/1177024890415|http://www.lexisnexis.com/hottopics/Colorado/
11490	CO	Vehicle Fleet Maintenance and Fuel Cost-Savings Contracts	Laws and Regulations				http://www.lexisnexis.com/hottopics/Colorado/
5759	CT	Alternative Fuel and Fuel-Efficient Vehicle Acquisition and Emissions Reduction Requirements	Laws and Regulations				http://www.cga.ct.gov|http://www.ct.gov/governorrell/cwp/browse.asp?a=1719&bc=0&c=18433
6248	CT	Biofuels Research Grants	State Incentives			GNT	http://www.cga.ct.gov/
6070	CT	Ethanol Labeling Requirement	Laws and Regulations				http://www.cga.ct.gov/
6249	CT	School Bus Emissions Reduction	Laws and Regulations			OTHER|GNT	http://www.cga.ct.gov/
11493	DC	Alternative Fuel Vehicle (AFV) and Infrastructure Tax Credit	State Incentives		2026-12-31 00:00:00 UTC	TAX	https://www.lexisnexis.com/hottopics/dccode/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
4323	DC	Alternative Fuel Vehicle Acquisition Requirements	Laws and Regulations				http://www.lexisnexis.com/hottopics/dccode/
5485	DC	Alternative Fuel Vehicle Exemption from Driving Restrictions	State Incentives			EXEM	http://www.lexisnexis.com/hottopics/dccode/
8665	DE	Alternative Fuel and Advanced Vehicle Acquisition Requirements	Laws and Regulations				http://governor.delaware.gov/orders/index.shtml
5331	DE	Alternative Fuel Tax Exemption	State Incentives			TAX|EXEM	http://delcode.delaware.gov/index.shtml
6552	FL	Alternative Fuel Economic Development	Laws and Regulations				http://www.flsenate.gov/Laws/
6074	FL	Biofuels Investment Tax Credit	State Incentives			TAX	http://www.flsenate.gov/Laws/
6423	FL	Biofuels Promotion	Laws and Regulations				http://www.flsenate.gov/Laws/
4338	FL	Ethanol Production Credit	State Incentives			OTHER	http://www.flsenate.gov/Laws/
6421	FL	Fuel-Efficient Vehicle Acquisition and Alternative Fuel Use Requirements	Laws and Regulations				http://www.flsenate.gov/Laws/
6424	FL	Provision for Renewable Fuels Investment	Laws and Regulations				http://www.flsenate.gov/Laws/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6072	FL	Renewable Energy and Energy Efficient Technology Grant Matching Program	State Incentives			GNT	http://www.flsenate.gov/Laws/
10253	GA	Alternative Fuel and Advanced Vehicle Job Creation Tax Credit	State Incentives			TAX	http://www.lexisnexis.com/hottopics/gacode/default.asp
4345	GA	Alternative Fuel Excise Tax	Laws and Regulations				http://www.legis.state.ga.us/
5424	GA	Alternative Fuel Vehicle (AFV) Tax Credit	State Incentives			TAX	http://www.legis.state.ga.us/
6514	GA	Alternative Fuels Production Assistance	State Incentives			OTHER	
6516	GA	Ethanol Blending Regulation	Laws and Regulations				http://www.legis.state.ga.us/
6567	HI	Alternative Fuel and Advanced Vehicle Acquisition Requirements	Laws and Regulations				http://www.capitol.hawaii.gov/
6078	HI	Alternative Fuel Standard Development	Laws and Regulations				http://www.capitol.hawaii.gov/
5451	HI	Alternative Fuel Tax Rate	Laws and Regulations				http://www.capitol.hawaii.gov/
6077	HI	Biofuels Procurement Preference	Laws and Regulations				http://www.capitol.hawaii.gov/
6417	HI	Biofuels Production Land Use Allowance and Exemption	Laws and Regulations				http://www.capitol.hawaii.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6416	HI	Clean Transportation Promotion	Laws and Regulations				
6230	HI	Energy Feedstock Program	Laws and Regulations				http://www.capitol.hawaii.gov/
6080	HI	Ethanol Fuel Blend Standard	Laws and Regulations				http://hawaii.gov/ltgov/office/adminrules|http://www.capitol.hawaii.gov/
5883	HI	Ethanol Production Incentive	State Incentives			TAX	http://www.capitol.hawaii.gov/
6226	IA	Alternative Fuel Production Tax Credits	State Incentives			TAX	
4413	IA	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
5236	IA	Alternative Fuel Vehicle (AFV) Demonstration Grants	State Incentives			GNT|OTHER	https://www.legis.iowa.gov/index.aspx
6428	IA	Biofuel Decal and Use Requirement	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
6081	IA	Biofuel Infrastructure Grants	State Incentives			GNT	https://www.legis.iowa.gov/index.aspx
9293	IA	E15 Retailer Tax Credit	State Incentives		2017-12-31 00:00:00 UTC	TAX	https://www.legis.iowa.gov/index.aspx
6117	IA	E85 Fuel Exclusivity Contract Regulations	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
6425	IA	E85 Retailer Tax Credit	State Incentives		2017-12-31 00:00:00 UTC	TAX	https://www.legis.iowa.gov/index.aspx

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8308	IA	Ethanol Blend Dispenser Requirement	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
5237	IA	Ethanol Blend Retailer Tax Credit	State Incentives			TAX	http://www.legis.iowa.gov/
5432	IA	Renewable Fuel Labeling Requirement	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
6183	ID	Ethanol Blended Fuel Definition	Laws and Regulations				http://legislature.idaho.gov/statutesrules.htm
6331	IL	Advanced Vehicle Acquisition and Biodiesel Fuel Use Requirement	Laws and Regulations				http://www.ilga.gov/|http://www.ilga.gov/|http://www.ilga.gov/legislation/ilcs/ilcs.asp
4368	IL	Alternative Fuel Vehicle (AFV) and Alternative Fuel Rebates	State Incentives			RBATE	
5698	IL	Alternative Fuel Vehicle (AFV) Fleet Incentives	State Incentives			OTHER	
6329	IL	Alternative Fuels Labeling Requirement	Laws and Regulations				
11507	IL	Biofuels Business Planning Grants	State Incentives			GNT	
6485	IL	Biofuels Education and Promotion	Laws and Regulations				
5699	IL	Biofuels Preference for State Vehicle Procurement	Laws and Regulations				
11022	IL	Biofuels Production Facility Grants	State Incentives			GNT	

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
11021	IL	E85 Fueling Infrastructure Grants	State Incentives			GNT	
8907	IL	Ethanol and Hydrogen Production Facility Permits	Laws and Regulations				
5996	IL	Ethanol Tax Exemption	State Incentives		2018-12-13 00:00:00 UTC	EXEM	
6623	IL	Fuel-Efficient Vehicle Acquisition Goals	Laws and Regulations				http://www.illinois.gov/Government/ExecOrders/Pages/default.aspx
8905	IL	School Bus Retrofit Reimbursement	State Incentives			RBATE	
6330	IL	State Government Energy Initiative	Laws and Regulations				
10938	IN	Alternative Fuel and Special Fuel Definitions	Laws and Regulations				http://www.in.gov/legislative/|http://www.in.gov/legislative/ic/code/
10796	IN	Alternative Fuel Vehicle (AFV) Inspection and Maintenance Exemption	State Incentives			EXEM	http://www.in.gov/legislative/iac/
6218	IN	Alternative Fuel Vehicle (AFV) Manufacturer Tax Credit	State Incentives		2016-12-31 00:00:00 UTC	TAX	http://www.in.gov/legislative/ic/code/
5877	IN	Biofuels Blend Use Requirement	Laws and Regulations				http://www.in.gov/legislative/ic/code/
5200	IN	Certified Technology Park Designation	Laws and Regulations				http://www.in.gov/legislative/ic/code/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
10794	IN	Community Alternative Fuel Vehicle (AFV) Fleet Grants	State Incentives			GNT	
10795	IN	Diesel Vehicle Retrofit and Improvement Grants	State Incentives			GNT	
6035	IN	E85 Definition	Laws and Regulations				http://www.in.gov/legislative/ic/code/
6221	IN	E85 Fuel Use Incentive	State Incentives		2019-01-01 00:00:00 UTC	RBATE	http://www.in.gov/legislative/ic/code/
6033	IN	E85 Promotion and Education	Laws and Regulations				http://www.in.gov/legislative/ic/code/
6034	IN	E85 Retail Sales Reporting	Laws and Regulations				http://www.in.gov/legislative/ic/code/
6220	IN	Ethanol Production Tax Credit	State Incentives			TAX	http://www.in.gov/dor/3512.htm
6032	IN	Immunity for Misuse of E85	Laws and Regulations				http://www.in.gov/legislative/ic/code/
6219	IN	Vehicle Research and Development Grants	State Incentives			GNT	http://www.in.gov/legislative/ic/code/
6405	KS	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.kslegislature.org/li/statute/
5169	KS	Alternative Fuel Vehicle (AFV) Tax Credit	State Incentives			TAX	http://www.kslegislature.org/li/statute/
5171	KS	Alternative Fueling Infrastructure Tax Credit	State Incentives			TAX	http://www.kslegislature.org/li/statute/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6543	KS	Biodiesel and Renewable Fuel Definitions	Laws and Regulations				http://www.kslegislature.org/li/statute/
8304	KS	Biofuel Blending Equipment Tax Exemption	State Incentives			EXEM|TAX	http://www.kslegislature.org/li/statute/
8306	KS	Biofuel Production Facility Tax Exemption	State Incentives			EXEM|TAX	http://www.kslegislature.org/li/statute/
5756	KS	Biofuels Use Requirement	Laws and Regulations				http://www.kslegislature.org/li/statute/
6404	KS	Cellulosic Ethanol Production Financing	State Incentives			LOANS	http://www.kslegislature.org/li/statute/
6203	KS	E85 Tax Rate and Definition	Laws and Regulations				http://www.kslegislature.org/li/statute/
8307	KS	Ethanol Blend Dispenser Requirement	Laws and Regulations				http://www.kssos.org/Pubs/pubs_kar.aspx
4425	KS	Ethanol Production Incentive	State Incentives			RBATE	http://www.kslegislature.org/li/statute/
6201	KS	Renewable Fuel Retailer Tax Incentive	State Incentives			TAX	http://www.kslegislature.org/li/statute/|http://www.kslegislature.org/li/
10741	KY	Alternative Fuel and Conversion Definitions	Laws and Regulations				
6294	KY	Alternative Fuel Production Tax Incentives	State Incentives			TAX	http://www.lrc.ky.gov/
6296	KY	Alternative Fuel Research, Development, and Promotion	State Incentives			GNT	http://lrc.ky.gov/krs/titles.htm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8281	KY	Biomass and Biofuels Industry Development	Laws and Regulations				http://apps.sos.ky.gov/executive/journal/(S(q5gd4e45idwizi45wea1ti55))/journal2.aspx
10743	KY	Clean Transportation Fuels for School Buses	Laws and Regulations				http://lrc.ky.gov/krs/titles.htm
10739	KY	Ethanol Infrastructure Grants	Utility/Private Incentives			GNT	
6409	KY	Ethanol Production Tax Credit	State Incentives			TAX	http://lrc.ky.gov/krs/titles.htm
10738	KY	On-Farm Biofuel Production Grants	State Incentives			GNT	
10740	KY	Request to Report Research on Second Generation Biofuels	Laws and Regulations				http://www.lrc.ky.gov/legislation.htm
6051	KY	State Energy Plan Alternative Fuel Requirements	Laws and Regulations				http://lrc.ky.gov/krs/titles.htm
6297	KY	Vehicle Acquisition Priorities and Alternative Fuel Use Requirement	Laws and Regulations				http://lrc.ky.gov/krs/titles.htm
6456	LA	Alternative Fuel and Advanced Vehicle Acquisition Requirements	Laws and Regulations				http://www.legis.state.la.us/
6603	LA	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Tax Credit	State Incentives			TAX	http://www.legis.la.gov/legis/home.aspx|http://doa.louisiana.gov/osr/lac/lac.htm|http://www.legis.state.la.us/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6104	LA	Biofuels Feedstock Requirements	Laws and Regulations				http://www.legis.state.la.us/
8420	LA	Compressed Natural Gas (CNG) Project Loans	State Incentives			LOANS	http://www.legis.state.la.us/
6604	LA	Provision for Green Jobs Tax Credit	Laws and Regulations			TAX	http://www.legis.state.la.us/
6103	LA	Renewable Fuel Standard	Laws and Regulations				http://www.legis.state.la.us/
10536	MA	Alternative Fuel Offering Requirement	Laws and Regulations				http://www.malegislature.gov/Laws/SessionLaws/Search|http://www.malegislature.gov/Laws/GeneralLaws/
6466	MA	Cellulosic Biofuel Tax Exemption	State Incentives			EXEM|TAX	http://www.mass.gov/dor/businesses/help-and-resources/legal-library/tirs/tirs-by-years/2009-releases/tir-09-4-an-act-relative-to-clean-energy.html|http://www.malegislature.gov/Laws/GeneralLaws/
6270	MA	State Agency Alternative Fuel Use Requirement	Laws and Regulations				http://www.mass.gov/anf/budget-taxes-and-procurement/admin-bulletins/
6468	MA	State Hybrid Electric (HEV) Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				htthttp://www.mass.gov/anf/budget-taxes-and-procurement/admin-bulletins/|http://www.malegislature.gov/Laws/GeneralLaws/|http://www.lawlib.state.ma.us/source/mass/eo/index.html
6053	MD	Alternative Fuel Use Requirement	Laws and Regulations				http://mgaleg.maryland.gov/webmga/frm1st.aspx?tab=home|http://www.dbm.maryland.gov/agencies/Documents/FleetManagementServices/fleet_mgmt_manual.pdf
5834	MD	Biofuels Production Incentive	State Incentives			TAX	http://mgaleg.maryland.gov/webmga/frm1st.aspx?tab=home

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6406	MD	Cellulosic Ethanol Research and Development Tax Credit	State Incentives		2016-12-31 00:00:00 UTC	TAX	http://mgaleg.maryland.gov/webmga/frm1st.aspx?tab=home
5297	ME	Alternative Fuel Tax Rates	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
5757	ME	Biofuels Production Tax Credit	State Incentives			TAX	http://www.mainelegislature.org/legis/statutes/
11042	ME	Prohibition of the Sale of Ethanol-Blended Gasoline	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
5729	ME	Provision for Establishment of Clean Fuel Vehicle Insurance Incentives	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
9401	ME	State Plan to Reduce Petroleum Consumption	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
5769	MI	Alternative Fuel Development Property Tax Exemption	State Incentives			EXEM|TAX	http://www.legislature.mi.gov/(S(kovblajtbo3pwn22ekizx255))/mileg.aspx?page=home
6122	MI	Biofuels Blender Requirements	Laws and Regulations				http://www.legislature.mi.gov/(S(chtz2jui1ekkqu45xjluze55))/mileg.aspx?page=home
4524	MN	Alternative Fuel Tax	Laws and Regulations				https://www.revisor.mn.gov/pubs/
6093	MN	Biofuel Blend Mandate	Laws and Regulations				http://www.leg.state.mn.us/|https://www.revisor.mn.gov/pubs/
6094	MN	Biofuel Use Requirement	Laws and Regulations				http://www.leg.state.mn.us/lrl/execorders/execorders.aspx|http://www.leg.state.mn.us/leg/legis.aspx
8540	MN	Cellulosic Ethanol Investment Tax Credit	State Incentives			TAX	https://www.revisor.mn.gov/pubs/
10983	MN	E85 Definition	Laws and Regulations				http://www.leg.state.mn.us/|https://www.revisor.mn.gov/pubs/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8541	MN	Ethanol Fuel Blend Dispensing Regulations	Laws and Regulations				https://www.revisor.mn.gov/pubs/
5194	MN	Ethanol Fueling Infrastructure Grants	State Incentives			GNT	
9398	MN	Ethanol Production Facility Environmental Assessment Exemption	State Incentives			EXEM	https://www.revisor.mn.gov/pubs/
10984	MN	NextGen Energy Board	Laws and Regulations				http://www.leg.state.mn.us/leg/legis.aspx|https://www.revisor.mn.gov/pubs/
9399	MN	State Agency Sustainability Plan and Requirements	Laws and Regulations				http://www.leg.state.mn.us/leg/legis.aspx|http://www.leg.state.mn.us/lrl/execorders/execorders.aspx|https://www.revisor.mn.gov/pubs/
4538	MO	Alternative Fuel Promotion	Laws and Regulations				http://www.moga.mo.gov/
5253	MO	Alternative Fuel Vehicle (AFV) Acquisition and Alternative Fuel Use Requirements	Laws and Regulations				http://www.moga.mo.gov/
5607	MO	Alternative Fuel Vehicle (AFV) Decal	Laws and Regulations				http://www.moga.mo.gov/|http://www.moga.mo.gov/
6450	MO	Alternative Fueling Infrastructure Tax Credit	State Incentives		2018-01-01 00:00:00 UTC	TAX	http://www.moga.mo.gov/|http://www.moga.mo.gov/
6083	MO	Ethanol Blend Mandate	Laws and Regulations				http://www.moga.mo.gov/
5250	MO	Ethanol Production Incentive	State Incentives		2015-12-31 00:00:00 UTC	RBATE	http://www.moga.mo.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
11553	MO	State Energy Plan	Laws and Regulations				http://governor.mo.gov/news/executive-orders
10792	MS	Alternative Fuel Vehicle Revolving Loan Program	State Incentives			LOANS	http://www.lexisnexis.com/hottopics/mscode/
5556	MS	Biofuels Production Incentive	State Incentives		2015-06-30 00:00:00 UTC	GNT	http://www.lexisnexis.com/hottopics/mscode/
8311	MS	Ethanol Labeling Requirement	Laws and Regulations				http://www.mdac.state.ms.us/agency/regulations_laws/reg_ pdfs/Subpart 4/08 - Petroleum Products Inspection Law.pdf
6049	MS	Fuel-Efficient and Alternative Fuel Vehicle Use	Laws and Regulations				http://www.lexisnexis.com/hottopics/mscode/
6196	MT	Alternative Fuel Production Property Tax Incentive	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
4547	MT	Alternative Fuel Vehicle (AFV) Conversion Tax Credit	State Incentives			TAX	
6168	MT	Ethanol Blend Mandate	Laws and Regulations				
6200	MT	Ethanol Fuel Blend Use Requirement	Laws and Regulations				http://leg.mt.gov/bills/mca_toc/index.htm
10855	MT	Ethanol Production Facility Property Tax Exemption	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
6166	MT	Ethanol Production Incentive	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5986	NC	Alternative Fuel and Alternative Fuel Vehicle (AFV) Fund	State Incentives			GNT	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
5294	NC	Alternative Fuel and Idle Reduction Grants	State Incentives			GNT	
5664	NC	Alternative Fuel Tax Exemption	State Incentives			TAX|EXEM	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
5988	NC	Alternative Fuel Use and Fuel-Efficient Vehicle Requirements	Laws and Regulations				
5484	NC	Alternative Fuel Vehicle (AFV) Acquisition Goal	Laws and Regulations				http://www.ncleg.net/gascripts/Statutes/Statutes.asp
6195	NC	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Support	State Incentives			GNT	
10412	NC	Alternative Fuels Feasibility Study	Laws and Regulations				http://www.ncga.state.nc.us/
6281	NC	Bond Exemption for Small Biofuels Suppliers	State Incentives			EXEM	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
9534	NC	Ethanol Blend Labeling Requirements	Laws and Regulations				http://www.ncleg.net/gascripts/Statutes/Statutes.asp|http://reports.oah.state.nc.us/ncac.asp
6477	NC	Ethanol Blend Requirement	Laws and Regulations				http://www.ncleg.net/gascripts/Statutes/Statutes.asp
5483	NC	Renewable Energy Property Tax Credit	State Incentives		2016-01-01 00:00:00 UTC	TAX	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
6550	ND	Advanced Biofuel Incentives	State Incentives			LOANS|GNT	http://www.legis.nd.gov/general-information/north-dakota-century-code

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8484	ND	Agriculturally-Based Fuel Production Wage and Salary Tax Credit	State Incentives			TAX	http://www.legis.nd.gov/general-information/north-dakota-century-code
9299	ND	Agriculturally-Derived Fuel Production Facility Loan Guarantees	State Incentives			LOANS	http://www.legis.nd.gov/general-information/north-dakota-century-code
6234	ND	Alternative Fuel Labeling Requirement	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code
5869	ND	Alternative Fuel Tax Rates	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code
5866	ND	Biofuel Loan Program	State Incentives			LOANS	http://www.legis.nd.gov/general-information/north-dakota-century-code
5218	ND	Ethanol Production Incentive	State Incentives			GNT	http://www.legis.nd.gov/general-information/north-dakota-century-code
6231	ND	Renewable Fuels Promotion	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code
5964	NE	Alternative Fuel Use	Laws and Regulations				http://nlc1.nlc.state.ne.us/docs/pilot/pubs/EOIndex.html
6252	NE	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Loans	State Incentives			LOANS	
9453	NE	Cellulosic Ethanol Investment Tax Credit	State Incentives			TAX	http://nebraskalegislature.gov/laws/browse-statutes.php
5735	NE	Ethanol and Biodiesel Tax Exemption	State Incentives			EXEM|TAX	http://nebraskalegislature.gov/laws/browse-statutes.php
10421	NH	Alternative Fuels Taxation Study Commission	Laws and Regulations				http://www.gencourt.state.nh.us/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
11101	NH	State Energy Strategy Development	Laws and Regulations				http://www.gencourt.state.nh.us/
9593	NJ	Biofuel Use Requirements	Laws and Regulations				
11200	NJ	Biofuels Promotion	Laws and Regulations				http://www.njleg.state.nj.us/
5493	NJ	Low Emission or Alternative Fuel Bus Acquisition Requirement	Laws and Regulations				http://lis.njleg.state.nj.us/cgi-bin/om_isapi.dll?clientID=109559&depth=2&expandheadings=off&headingswithhits=on&infobase=statutes.nfo&softpage=TOC_Frame_Pg42
5391	NM	Alternative Fuel Definition	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
9053	NM	Alternative Fuel Tax Exemption	State Incentives			TAX|EXEM	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
4600	NM	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants	State Incentives			GNT	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
4605	NM	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Acquisition Requirements	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
4607	NM	Alternative Fuels Tax	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx|http://www.nmlegis.gov/lcs/default.aspx
5826	NM	Biofuels Production Tax Deduction	State Incentives			TAX	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
6522	NM	Green Jobs Training Program	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5266	NV	Alternative Fuel Vehicle (AFV) Acquisition Requirement	Laws and Regulations				http://www.leg.state.nv.us/law1.cfm
6251	NV	Funds for School District Alternative Fuel Use	Laws and Regulations				http://www.leg.state.nv.us/law1.cfm
5263	NV	Provision for Establishment of Alternative Fuel Incentives	Laws and Regulations				http://www.leg.state.nv.us/law1.cfm
6108	NY	Alternative Fuel Tax Exemption and Rate Reduction	State Incentives		2014-09-01 00:00:00 UTC	EXEM|TAX	http://public.leginfo.state.ny.us/menuf.cgi
5328	NY	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.ogs.state.ny.us/purchase/spg/pdfdocs/EO142_EEP.pdf|http://www.dec.ny.gov/energy/71389.html|http://www.potsdam.edu/about/sustainability/links/upload/EO111.pdf
5325	NY	Alternative Fuel Vehicle Research and Development Funding	State Incentives			GNT|OTHER	
6302	NY	Biofuel Production Tax Credit	State Incentives		2019-12-31 00:00:00 UTC	TAX	http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS
6109	NY	Fuel Exclusivity Contract Regulation	Laws and Regulations				http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS
6024	OH	Alternative Fuel and Fueling Infrastructure Incentives	State Incentives			GNT	http://codes.ohio.gov/|http://www.legislature.state.oh.us/
8980	OH	Alternative Fuel Signage	Laws and Regulations				http://codes.ohio.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6164	OH	Alternative Fuel Vehicle (AFV) Acquisition and Fuel Use Requirements	Laws and Regulations				http://www.dsireusa.org/documents/Incentives/EO 2007-02S.pdf|http://www.legislature.state.oh.us/|http://www.afdc.energy.gov/laws/laws/ http:/codes.ohio.gov/
5338	OH	Alternative Fuel Vehicle Conversion	Laws and Regulations				http://www.afdc.energy.gov/laws/laws/ http:/codes.ohio.gov/
6501	OH	School Bus Retrofit Grant Program	State Incentives			GNT	
6561	OK	Access to State Alternative Fueling Stations	Laws and Regulations				http://www.oklegislature.gov/
11047	OK	Alternative Fuel School Bus Conversion Research	Laws and Regulations				https://www.sos.ok.gov/gov/execorders.aspx
5216	OK	Alternative Fuel Technician Training	Laws and Regulations				http://www.oklegislature.gov/
5612	OK	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.oklegislature.gov/
4668	OK	Alternative Fuel Vehicle (AFV) Low-Interest Loans	State Incentives			LOANS	
11045	OK	Biofuels Construction and Permitting Assistance	State Incentives			OTHER	
6242	OK	Biofuels Tax Exemption	State Incentives			EXEM	http://www.oklegislature.gov/
6092	OK	Ethanol Fuel Retailer Tax Credit	State Incentives			TAX	http://www.oklegislature.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6449	OK	Ethanol Labeling Requirement	Laws and Regulations				http://www.oklegislature.gov/
11044	OK	Ethanol Sales Tax Exemption	State Incentives			EXEM	http://www.oklegislature.gov/
4684	OR	Alternative Fuel Loans	State Incentives			LOANS	http://www.leg.state.or.us/ors/home.htm
4688	OR	Alternative Fuel Vehicle (AFV) Acquisition, Fuel Use, and Emissions Reductions Requirements	Laws and Regulations				http://www.leg.state.or.us/ors/home.htm|http://governor.oregon.gov/Gov/exec_orders.shtml
9555	OR	Alternative Fuel Vehicle (AFV) and Infrastructure Tax Credit for Businesses	State Incentives			TAX	http://www.leg.state.or.us/ors/home.htm
11063	OR	Alternative Fuel Vehicle (AFV) Loan Program	State Incentives			LOANS	http://www.leg.state.or.us/|http://www.leg.state.or.us/ors/home.htm
5315	OR	Alternative Fueling Infrastructure Tax Credit for Residents	State Incentives			TAX	http://www.leg.state.or.us/ors/home.htm
6273	OR	Biofuels Production Property Tax Exemption	State Incentives			TAX	http://www.leg.state.or.us/ors/home.htm
6276	OR	Biofuels Program Impact Studies	Laws and Regulations		2025-01-01 00:00:00 UTC		http://www.leg.state.or.us/ors/home.htm
6606	OR	Clean Transportation Fuel Standards	Laws and Regulations				http://sos.oregon.gov/archives/Pages/oregon_administrative_rules.aspx|http://www.leg.state.or.us/ors/home.htm
6274	OR	Renewable Fuels Mandate	Laws and Regulations				http://arcweb.sos.state.or.us/banners/rules.htm|http://www.leg.state.or.us/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6324	PA	Alternative Fuel Development and Deployment Grants	State Incentives			GNT	
5812	PA	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Funding	State Incentives			GNT|RBATE	
5376	PA	Alternative Fuels Tax	Laws and Regulations				
6486	PA	Renewable Fuels Mandate	Laws and Regulations				
5970	RI	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Acquisition Requirements	Laws and Regulations				http://www.afdc.energy.gov/pdfs/Exec_order_5_13_green_clean_vehicles.pdf
11523	RI	State Agency Coordination to Address Climate Change	Laws and Regulations				http://webserver.rilin.state.ri.us/legislation/|http://webserver.rilin.state.ri.us/Statutes/
11516	SC	Alternative Fuel School Bus Pilot Program	State Incentives		2015-06-01 00:00:00 UTC	LOANS|OTHER	http://www.scstatehouse.gov/index.php
11518	SC	Alternative Fuel Vehicle (AFV) Revolving Loan Program for Private Entities	State Incentives			LOANS	http://www.scstatehouse.gov/code/statmast.php
11517	SC	Alternative Fuel Vehicle (AFV) Revolving Loan Program for Public Entities	State Incentives			LOANS	http://www.scstatehouse.gov/code/statmast.php

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8561	SC	Biofuel Blending Capability Requirements and Liability	Laws and Regulations				http://www.scstatehouse.gov/code/statmast.php
6262	SC	Biofuels Distribution Infrastructure Tax Credit	State Incentives			TAX	http://www.scstatehouse.gov/code/statmast.php
6263	SC	Biofuels Production Facility Tax Credit	State Incentives			TAX	http://www.scstatehouse.gov/code/statmast.php
11520	SC	Clean Energy Advisory Commission	State Incentives			OTHER	http://www.scstatehouse.gov/code/statmast.php|http://www.scstatehouse.gov/index.php
6458	SC	State Agency Preference for Alternative Fuel and Advanced Vehicles	Laws and Regulations				http://www.scstatehouse.gov/code/statmast.php
9193	SD	Biofuel Franchising Contract Regulations	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
5134	SD	Ethanol and Biobutanol Production Incentive	State Incentives			TAX	http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6186	SD	Ethanol and Methanol Tax	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6187	SD	Ethanol Blend Definition	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
9192	SD	Ethanol Infrastructure Funding	State Incentives			RBATE	http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6190	SD	Ethanol Production Facility Fee	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6189	SD	Fuel Quality Standards	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6245	TN	Alternative Fuel and Fuel-Efficient Vehicle Acquisition and Use Requirements	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/|http://www.capitol.tn.gov/|http://www.state.tn.us/sos/pub/execorders/index.htm
6435	TN	Biodiesel and Ethanol Definitions and Retail Requirements	Laws and Regulations				http://www.tennessee.gov/sos/rules/0080/0080.htm
8501	TN	Biofuel Blending Contract Regulation	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
6061	TN	Biofuel Fueling Infrastructure Grants	State Incentives			GNT	http://www.lexisnexis.com/hottopics/michie/|http://www.state.tn.us/sos/pub/execorders/index.htm
6436	TN	Biofuels Production Promotion	Laws and Regulations				http://www.legislature.state.tn.us/
5961	TN	Biofuels Quality Specifications	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
6434	TN	Energy Task Force	Laws and Regulations				http://www.state.tn.us/sos/pub/execorders/index.htm
6574	TN	Supply of Petroleum Products for Blending with Biofuels	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
6585	TX	Alternative Fuel Use and Vehicle Acquisition Requirements	Laws and Regulations				http://www.statutes.legis.state.tx.us/
11499	TX	Clean School Bus Program	State Incentives			GNT	http://www.sos.state.tx.us/tac/index.shtml/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5309	TX	Clean Vehicle and Infrastructure Grants	State Incentives			GNT	http://www.statutes.legis.state.tx.us/
5641	TX	Diesel Fuel Blend Tax Exemption	State Incentives			EXEM|TAX	http://www.statutes.legis.state.tx.us/
6240	TX	Fuel Dispenser Labeling Requirement	Laws and Regulations				http://www.statutes.legis.state.tx.us/
6586	TX	Renewable Fuel Promotion	Laws and Regulations				http://www.statutes.legis.state.tx.us/
10292	US	Advanced Biofuel Feedstock Incentives	Incentives	U.S. Department of Agriculture		RBATE|OTHER	http://www.gpo.gov/fdsys/|http://www.congress.gov/
8502	US	Advanced Biofuel Production Grants and Loan Guarantees	Incentives	U.S. Department of Agriculture		LOANS	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/
8503	US	Advanced Biofuel Production Payments	Incentives	U.S. Department of Agriculture		GNT	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/|http://www.congress.gov/
8082	US	Advanced Energy Research Project Grants	Incentives	U.S. Department of Energy		GNT	
388	US	Aftermarket Alternative Fuel Vehicle (AFV) Conversions	Laws and Regulations	U.S. Environmental Protection Agency			
274	US	Air Pollution Control Program	Programs	U.S. Environmental Protection Agency		GNT	
10612	US	Alternative Fuel and Advanced Vehicle Technology Research and Demonstration Bonds	Incentives	U.S. Internal Revenue Service		LOANS	

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
391	US	Alternative Fuel Definition	Laws and Regulations	U.S. Department of Energy			
11220	US	Alternative Fuel Excise Tax	Laws and Regulations	U.S. Internal Revenue Service			
10513	US	Alternative Fuel Infrastructure Tax Credit	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX	http://www.gpo.gov/fdsys/|http://www.irs.gov/pub/irs-drop/n-07-43.pdf|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|https://www.congress.gov/
8060	US	Alternative Fuel Labeling Requirements	Laws and Regulations	Federal Trade Commission			
382	US	Biobased Transportation Research Funding	Incentives	U.S. Department of Transportation		GNT	
8504	US	Biodiesel Education Grants	Incentives	U.S. Department of Agriculture		GNT	http://www.gpo.gov/fdsys/|http://www.congress.gov/|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112
378	US	Biomass Research and Development Initiative	Incentives	U.S. Department of Agriculture		GNT	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112||http://www.gpo.gov/fdsys/|http://www.congress.gov/
288	US	Clean Cities	Programs	U.S. Department of Energy		OTHER|GNT	
284	US	Congestion Mitigation and Air Quality (CMAQ) Improvement Program	Programs	U.S. Department of Transportation		GNT	
9172	US	Ethanol Infrastructure Grants and Loan Guarantees	Incentives	U.S. Department of Agriculture		GNT|LOANS	http://www.congress.gov/|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
386	US	High Occupancy Vehicle (HOV) Lane Exemption	Laws and Regulations	U.S. Department of Transportation			http://www.gpo.gov/fdsys/|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112
392	US	Improved Energy Technology Loans	Incentives	U.S. Department of Energy		LOANS	
11552	US	Low- and Zero-Emission Vehicle Research, Demonstration, and Deployment Funding	Incentives	U.S. Department of Transportation		GNT|OTHER	
390	US	Renewable Fuel Standard (RFS) Program	Laws and Regulations	U.S. Environmental Protection Agency			
11560	US	Second Generation Biofuel Production Property Depreciation Allowance	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX|OTHER	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/
10515	US	Second Generation Producer Tax Credit	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/|https://www.congress.gov/
317	US	State Energy Program (SEP) Funding	Programs	U.S. Department of Energy		GNT	
379	US	Value-Added Producer Grants (VAPG)	Incentives	U.S. Department of Agriculture	2018-12-31 00:00:00 UTC	GNT	http://www.congress.gov/|http://www.gpo.gov/fdsys/
357	US	Vehicle Acquisition and Fuel Use Requirements for Federal Fleets	Laws and Regulations	U.S. Department of Energy			

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
358	US	Vehicle Acquisition and Fuel Use Requirements for Private and Local Government Fleets	Laws and Regulations	U.S. Department of Energy			
347	US	Vehicle Acquisition and Fuel Use Requirements for State and Alternative Fuel Provider Fleets	Laws and Regulations	U.S. Department of Energy			
344	US	Vehicle Incremental Cost Allocation	Laws and Regulations	U.S. General Services Administration			
383	US	Voluntary Airport Low Emission (VALE) Program	Programs	U.S. Department of Transportation		GNT	
4764	UT	Provision for Establishment of Alternative Fuel Use Mandate	Laws and Regulations				http://le.utah.gov/xcode/code.html
10492	VA	Agriculture and Forestry Biofuel Production Grants	State Incentives			GNT	http://lis.virginia.gov/000/src.htm
4789	VA	Alternative Fuel and Vehicle Tax	Laws and Regulations				http://lis.virginia.gov/000/src.htm|http://virginiageneralassembly.gov/
4796	VA	Alternative Fuel License	Laws and Regulations				http://lis.virginia.gov/000/src.htm
10674	VA	Alternative Fuel Tax Exemption	State Incentives			EXEM|TAX	http://lis.virginia.gov/000/src.htm
4781	VA	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Loans	State Incentives			LOANS	http://lis.virginia.gov/000/src.htm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
9853	VA	Alternative Fuel Vehicle (AFV) Conversion Fund	Laws and Regulations				http://virginiageneralassembly.gov/|http://lis.virginia.gov/000/src.htm
8241	VA	Biofuel Feedstock Registration Exemption	State Incentives			EXEM	http://lis.virginia.gov/000/src.htm
6046	VA	Biofuels Production Grants	State Incentives			GNT	http://virginiageneralassembly.gov/|http://lis.virginia.gov/000/src.htm
9835	VA	Ethanol Production Equipment Tax Exemption	State Incentives			EXEM|TAX	http://lis.virginia.gov/000/src.htm
6065	VA	State Energy Plan	Laws and Regulations				http://virginiageneralassembly.gov/|http://lis.virginia.gov/000/src.htm
5622	VT	Alternative Fuel and Advanced Vehicle Research and Development Tax Credit	State Incentives			TAX	http://www.leg.state.vt.us/statutesMain.cfm
5625	VT	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.leg.state.vt.us/statutesMain.cfm
10295	VT	Alternative Fuel Vehicle (AFV) User Fee Study	Laws and Regulations				http://www.leg.state.vt.us/
5754	VT	State Agency Energy Plan Transportation Requirements	Laws and Regulations				http://www.leg.state.vt.us/statutes/fullchapter.cfm?Title=03APPENDIX&Chapter=010|http://www.leg.state.vt.us/statutesMain.cfm
6214	WA	Alternative Fuel Use Requirement	Laws and Regulations				http://apps.leg.wa.gov/rcw/|http://apps.leg.wa.gov/wac/
6537	WA	Biofuel Blend Dispenser Labeling Requirement	Laws and Regulations				http://apps.leg.wa.gov/wac/|http://apps.leg.wa.gov/rcw/
6410	WA	Biofuel Quality Program	Laws and Regulations				http://apps.leg.wa.gov/rcw/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
9396	WA	Biofuel Volume Rebate Program - Propel Fuels	Utility/Private Incentives			RBATE	
6208	WA	Biofuels Distribution Tax Exemption	State Incentives		2015-07-01 00:00:00 UTC	EXEM|TAX	http://apps.leg.wa.gov/rcw/
6213	WA	Biofuels Production and Distribution Contracts	Laws and Regulations				http://apps.leg.wa.gov/rcw/
5721	WA	Biofuels Production Tax Exemption	State Incentives		2015-12-31 00:00:00 UTC	TAX|EXEM	http://apps.leg.wa.gov/rcw/
5580	WA	Biofuels Tax Deduction	State Incentives		2015-07-01 00:00:00 UTC	TAX	http://apps.leg.wa.gov/rcw/
6530	WA	Clean and Efficient Fleet Assistance	Utility/Private Incentives			OTHER	
6210	WA	E85 Definition	Laws and Regulations				http://apps.leg.wa.gov/rcw/
6535	WA	Provision for Alternative Fuels Corridor Pilot Projects	Laws and Regulations				http://apps.leg.wa.gov/rcw/|http://www.governor.wa.gov/office/execorders/default.aspx
6040	WA	Renewable Fuel Standard	Laws and Regulations				http://apps.leg.wa.gov/rcw/
6217	WA	State Emissions Reductions Requirements	Laws and Regulations				http://www.governor.wa.gov/office/execorders/eoarchive/default.aspx|http://apps.leg.wa.gov/rcw/
9977	WA	State Vehicle Purchasing Guidance	Laws and Regulations				http://apps.leg.wa.gov/rcw/
5336	WI	Alternative Fuel License	Laws and Regulations				http://www.legis.state.wi.us/rsb/stats.html
5334	WI	Alternative Fuel Tax Exemption	State Incentives			EXEM	http://legis.wisconsin.gov/rsb/stats.html

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
4841	WI	Alternative Fuel Vehicle Acquisition and Alternative Fuel Use Requirements	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
8975	WI	Alternative Fueling Infrastructure Development	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
8974	WI	Petroleum Reduction Requirements	Laws and Regulations				http://docs.legis.wisconsin.gov/code/executive_orders/2003_jim_doyle/2006-141.pdf|http://legis.wisconsin.gov/rsb/stats.html
6475	WI	Renewable Fuel Infrastructure Tax Credit	State Incentives			TAX	http://legis.wisconsin.gov/rsb/stats.html
8972	WI	Renewable Fuel Producer Excise Tax and Inspection Exemption	State Incentives			TAX|EXEM	http://legis.wisconsin.gov/rsb/stats.html
8976	WI	Renewable Fuel Sales Volume Goals	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
8978	WI	Sustainable Biofuels Production Practices	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
4823	WV	Alternative Fuel Production Subsidy Prohibition	Laws and Regulations				
9154	WV	Alternative Fuel Use Requirement	Laws and Regulations				http://www.legis.state.wv.us/WVCODE/Code.cfm
10712	WV	Alternative Fuels Tax	Laws and Regulations				http://www.legis.state.wv.us/WVCODE/Code.cfm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5392	WV	Provision for Establishment of Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.legis.state.wv.us/WVCODE/Code.cfm
5393	WY	Ethanol License	Laws and Regulations				http://legisweb.state.wy.us/statutes/statutes.aspx

Source: Department of Energy, Energy Efficiency & Renewable Energy, Alternative Fuels Data Center
http://www.afdc.energy.gov/data_download/

Table D3. Biodiesel Law and Incentives

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
10292	US	Advanced Biofuel Feedstock Incentives	Incentives	U.S. Department of Agriculture		RBATE| OTHER	http://www.gpo.gov/fdsys/|http://www.congress.gov/
8502	US	Advanced Biofuel Production Grants and Loan Guarantees	Incentives	U.S. Department of Agriculture		LOANS	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/
8503	US	Advanced Biofuel Production Payments	Incentives	U.S. Department of Agriculture		GNT	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/|http://www.congress.gov/
8082	US	Advanced Energy Research Project Grants	Incentives	U.S. Department of Energy		GNT	
274	US	Air Pollution Control Program	Programs	U.S. Environmental Protection Agency		GNT	
10612	US	Alternative Fuel and Advanced Vehicle Technology Research and Demonstration Bonds	Incentives	U.S. Internal Revenue Service		LOANS	
391	US	Alternative Fuel Definition	Laws and Regulations	U.S. Department of Energy			
11220	US	Alternative Fuel Excise Tax	Laws and Regulations	U.S. Internal Revenue Service			
10513	US	Alternative Fuel Infrastructure Tax Credit	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX	http://www.gpo.gov/fdsys/|http://www.irs.gov/pub/irs-drop/n-07-43.pdf|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|https://www.congress.gov/
8060	US	Alternative Fuel Labeling Requirements	Laws and Regulations	Federal Trade Commission			

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
382	US	Biobased Transportation Research Funding	Incentives	U.S. Department of Transportation		GNT	
8504	US	Biodiesel Education Grants	Incentives	U.S. Department of Agriculture		GNT	http://www.gpo.gov/fdsys/|http://www.congress.gov/|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112
396	US	Biodiesel Income Tax Credit	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|https://www.congress.gov/|http://www.gpo.gov/fdsys/
395	US	Biodiesel Mixture Excise Tax Credit	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/|https://www.congress.gov/
378	US	Biomass Research and Development Initiative	Incentives	U.S. Department of Agriculture		GNT	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112||http://www.gpo.gov/fdsys/|http://www.congress.gov/
387	US	Clean Agriculture USA	Programs	U.S. Environmental Protection Agency		GNT	
288	US	Clean Cities	Programs	U.S. Department of Energy		OTHER|GNT	
324	US	Clean Construction USA	Programs	U.S. Environmental Protection Agency		GNT	
325	US	Clean Ports USA	Programs	U.S. Environmental Protection Agency		GNT|OTHER	
323	US	Clean School Bus USA	Programs	U.S. Environmental Protection Agency		GNT	

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
284	US	Congestion Mitigation and Air Quality (CMAQ) Improvement Program	Programs	U.S. Department of Transportation		GNT	
386	US	High Occupancy Vehicle (HOV) Lane Exemption	Laws and Regulations	U.S. Department of Transportation			http://www.gpo.gov/fdsys/|http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112
392	US	Improved Energy Technology Loans	Incentives	U.S. Department of Energy		LOANS	
11552	US	Low- and Zero-Emission Vehicle Research, Demonstration, and Deployment Funding	Incentives	U.S. Department of Transportation		GNT|OTHER	
389	US	National Clean Diesel Campaign (NCDC)	Programs	U.S. Environmental Protection Agency		OTHER|GNT	
390	US	Renewable Fuel Standard (RFS) Program	Laws and Regulations	U.S. Environmental Protection Agency			
10515	US	Second Generation Producer Tax Credit	Incentives	U.S. Internal Revenue Service	2014-12-31 00:00:00 UTC	TAX	http://thomas.loc.gov/home/LegislativeData.php?&n=PublicLaws&c=112|http://www.gpo.gov/fdsys/|https://www.congress.gov/
273	US	SmartWay Transport Partnership	Programs	U.S. Environmental Protection Agency		GNT|LOANS	
317	US	State Energy Program (SEP) Funding	Programs	U.S. Department of Energy		GNT	
379	US	Value-Added Producer Grants (VAPG)	Incentives	U.S. Department of Agriculture	2018-12-31 00:00:00 UTC	GNT	http://www.congress.gov/|http://www.gpo.gov/fdsys/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
357	US	Vehicle Acquisition and Fuel Use Requirements for Federal Fleets	Laws and Regulations	U.S. Department of Energy			
358	US	Vehicle Acquisition and Fuel Use Requirements for Private and Local Government Fleets	Laws and Regulations	U.S. Department of Energy			
347	US	Vehicle Acquisition and Fuel Use Requirements for State and Alternative Fuel Provider Fleets	Laws and Regulations	U.S. Department of Energy			
344	US	Vehicle Incremental Cost Allocation	Laws and Regulations	U.S. General Services Administration			
383	US	Voluntary Airport Low Emission (VALE) Program	Programs	U.S. Department of Transportation		GNT	
5197	AK	Alternative Fuel Vehicle Acquisition Requirement	Laws and Regulations				http://www.legis.state.ak.us/folhome.htm
6253	AL	Alternative Fuels Promotion and Information	Laws and Regulations				http://alisondb.legislature.state.al.us/acas/ACASLogin.asp
6544	AL	Biodiesel Fuel Storage Grants	State Incentives			GNT	
6545	AL	Biofuel Production Facility Tax Credit	State Incentives			TAX	http://alisondb.legislature.state.al.us/acas/ACASLoginfire.asp
6546	AL	Fuel-Efficient Green Fleets Policy and Fleet Management Program Development	Laws and Regulations				http://alisondb.legislature.state.al.us/acas/ACASLoginfire.asp|http://governor.alabama.gov/news/newsroom.aspx?t=29
9218	AR	Alternative Fuel Definition and Specifications	Laws and Regulations				http://www.arkleg.state.ar.us/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5817	AR	Alternative Fuel Vehicle Conversion	Laws and Regulations				http://www.arkleg.state.ar.us/
5815	AR	Alternative Fuels Tax and Reporting	Laws and Regulations				http://www.arkleg.state.ar.us/
6193	AR	Biodiesel Use Requirement	Laws and Regulations				http://www.arkleg.state.ar.us/
11579	AR	Personal Use Biofuel Reporting	Laws and Regulations				http://www.arkleg.state.ar.us
8384	AZ	Biofuels Definitions and Specifications	Laws and Regulations				http://www.azleg.gov/ArizonaRevisedStatutes.asp
6205	AZ	Clean Fuel Contracts for Heavy-Duty Equipment	Laws and Regulations				http://www.azland.gov/programs/natural/pdfs/ExecOrder.pdf
8402	AZ	Federal Fleet Operation Regulations	Laws and Regulations				http://www.azleg.state.az.us/
8400	AZ	Municipal Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.azleg.state.az.us/
8401	AZ	School District Alternative Fuel Vehicle Acquisition Requirements	Laws and Regulations				http://www.azleg.state.az.us/
5188	AZ	State Vehicle Acquisition and Fuel Use Requirements	Laws and Regulations				http://azmemory.azlibrary.gov/cdm/singleitem/collection/execorders/id/700|http://www.azleg.gov/ArizonaRevisedStatutes.asp
6490	CA	Alternative Fuel and Plug-in Hybrid Electric Vehicle Retrofit Regulations	Laws and Regulations				http://www.oal.ca.gov/
6307	CA	Alternative Fuel and Vehicle Incentives	State Incentives			GNT|LOANS	http://www.oal.ca.gov/|http://www.legislature.ca.gov/
5681	CA	Alternative Fuel and Vehicle Policy Development	Laws and Regulations				http://www.oal.ca.gov/|http://www.legislature.ca.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
10393	CA	Alternative Fuel Vehicle (AFV) Parking Incentive Programs	Laws and Regulations				http://www.oal.ca.gov/
9395	CA	Biofuel Volume Rebate Program - Propel Fuels	Utility/Private Incentives			RBATE	
4219	CA	Employer Invested Emissions Reduction Funding - South Coast	State Incentives			GNT	
5502	CA	Fleet Emissions Reduction Requirements - South Coast	Laws and Regulations				http://www.aqmd.gov/rules/rulesreg.html
6308	CA	Low Carbon Fuel Standard	Laws and Regulations				http://gov.ca.gov/s_executiveorders.php|http://www.oal.ca.gov/
6493	CA	Low Emission Vehicle (LEV) Standards	Laws and Regulations				http://www.oal.ca.gov/
6134	CA	Low Emission Vehicle Incentives and Technical Training - San Joaquin Valley	State Incentives			GNT|OTHER|RBATE	
5357	CA	Low Emissions School Bus Grants	State Incentives			GNT	http://www.oal.ca.gov/
5682	CA	Mobile Source Emissions Reduction Requirements	Laws and Regulations				http://www.oal.ca.gov/
6619	CA	State Transportation Plan	Laws and Regulations				http://www.oal.ca.gov/
11160	CA	Support for Advance Biofuel Development	Laws and Regulations				http://www.oal.ca.gov/
6492	CA	Vehicle Acquisition and Petroleum Reduction Requirements	Laws and Regulations				http://www.documents.dgs.ca.gov/ofa/eos-14-09.pdf|http://www.oal.ca.gov/|http://leginfo.legislature.ca.gov/faces/billSearchClient.xhtml

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6289	CO	Alternative Fuel Definition	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
11565	CO	Alternative Fuel Vehicle (AFV) Fleet Technical Assistance	State Incentives			OTHER	
5887	CO	Alternative Fuel Vehicle (AFV) Registration	Laws and Regulations				http://www.lexisnexis.com/hottopics/Colorado/
6290	CO	Biofuels Research Grants	State Incentives			GNT	http://www.lexisnexis.com/hottopics/michie/
11489	CO	Biogas Production Sales Tax Exemption	State Incentives			EXEM	
4274	CO	Gasoline and Diesel Gallon Equivalent Definition	Laws and Regulations				http://www.lexisnexis.com/hottopics/Colorado/
6293	CO	Renewable and Alternative Fuel Storage Tank Regulations	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/|http://www.sos.state.co.us/CCR/Welcome.do
5619	CO	State Agency Alternative Fuel Use and Vehicle Acquisition Requirement	Laws and Regulations				http://www.colorado.gov/cs/Satellite/GovRitter/GOVR/1177024890415|http://www.lexisnexis.com/hottopics/Colorado/
11490	CO	Vehicle Fleet Maintenance and Fuel Cost-Savings Contracts	Laws and Regulations				http://www.lexisnexis.com/hottopics/Colorado/
5759	CT	Alternative Fuel and Fuel-Efficient Vehicle Acquisition and Emissions Reduction Requirements	Laws and Regulations				http://www.cga.ct.gov|http://www.ct.gov/governorrell/cwp/browse.asp?a=1719&bc=0&c=18433
6248	CT	Biofuels Research Grants	State Incentives			GNT	http://www.cga.ct.gov/
6249	CT	School Bus Emissions Reduction	Laws and Regulations			OTHER|GNT	http://www.cga.ct.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
11493	DC	Alternative Fuel Vehicle (AFV) and Infrastructure Tax Credit	State Incentives		2026-12-31 00:00:00 UTC	TAX	https://www.lexisnexis.com/hottopics/dccode/
5485	DC	Alternative Fuel Vehicle Exemption from Driving Restrictions	State Incentives			EXEM	http://www.lexisnexis.com/hottopics/dccode/
8665	DE	Alternative Fuel and Advanced Vehicle Acquisition Requirements	Laws and Regulations				http://governor.delaware.gov/orders/index.shtml
5331	DE	Alternative Fuel Tax Exemption	State Incentives			TAX|EXEM	http://delcode.delaware.gov/index.shtml
6552	FL	Alternative Fuel Economic Development	Laws and Regulations				http://www.flsenate.gov/Laws/
10854	FL	Biodiesel Producer Fuel Tax	Laws and Regulations				http://www.flsenate.gov/Session/Bills|http://www.flsenate.gov/Laws/
6074	FL	Biofuels Investment Tax Credit	State Incentives			TAX	http://www.flsenate.gov/Laws/
6423	FL	Biofuels Promotion	Laws and Regulations				http://www.flsenate.gov/Laws/
8386	FL	Excise Tax Exemption for Biodiesel Produced by Schools	State Incentives			TAX|EXEM	http://www.flsenate.gov/Laws/
6421	FL	Fuel-Efficient Vehicle Acquisition and Alternative Fuel Use Requirements	Laws and Regulations				http://www.flsenate.gov/Laws/
6424	FL	Provision for Renewable Fuels Investment	Laws and Regulations				http://www.flsenate.gov/Laws/
6072	FL	Renewable Energy and Energy Efficient Technology Grant Matching Program	State Incentives			GNT	http://www.flsenate.gov/Laws/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
10253	GA	Alternative Fuel and Advanced Vehicle Job Creation Tax Credit	State Incentives			TAX	http://www.lexisnexis.com/hottopics/gacode/default.asp
4345	GA	Alternative Fuel Excise Tax	Laws and Regulations				http://www.legis.state.ga.us/
5424	GA	Alternative Fuel Vehicle (AFV) Tax Credit	State Incentives			TAX	http://www.legis.state.ga.us/
6514	GA	Alternative Fuels Production Assistance	State Incentives			OTHER	
6048	GA	Biodiesel Specifications	Laws and Regulations				http://www.legis.state.ga.us/
6567	HI	Alternative Fuel and Advanced Vehicle Acquisition Requirements	Laws and Regulations				http://www.capitol.hawaii.gov/
6078	HI	Alternative Fuel Standard Development	Laws and Regulations				http://www.capitol.hawaii.gov/
5451	HI	Alternative Fuel Tax Rate	Laws and Regulations				http://www.capitol.hawaii.gov/
6077	HI	Biofuels Procurement Preference	Laws and Regulations				http://www.capitol.hawaii.gov/
6417	HI	Biofuels Production Land Use Allowance and Exemption	Laws and Regulations				http://www.capitol.hawaii.gov/
6416	HI	Clean Transportation Promotion	Laws and Regulations				
6230	HI	Energy Feedstock Program	Laws and Regulations				http://www.capitol.hawaii.gov/
6226	IA	Alternative Fuel Production Tax Credits	State Incentives			TAX	

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
4413	IA	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
5236	IA	Alternative Fuel Vehicle (AFV) Demonstration Grants	State Incentives			GNT|OTHER	https://www.legis.iowa.gov/index.aspx
6082	IA	Biodiesel Blend Retailer Tax Credit	State Incentives			TAX	https://www.legis.iowa.gov/index.aspx
5235	IA	Biodiesel Fuel Use	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
10073	IA	Biodiesel Producer Tax Refund	State Incentives		2018-01-01 00:00:00 UTC	TAX	https://www.legis.iowa.gov/index.aspx|https://www.legis.iowa.gov/
6081	IA	Biofuel Infrastructure Grants	State Incentives			GNT	https://www.legis.iowa.gov/index.aspx
9294	IA	Biofuel Specifications	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
5432	IA	Renewable Fuel Labeling Requirement	Laws and Regulations				https://www.legis.iowa.gov/index.aspx
8301	ID	Alternative Fuels Tax Exemption and Refund	State Incentives			TAX	http://legislature.idaho.gov/statutesrules.htm
5406	ID	Biodiesel Definitions	Laws and Regulations				http://legislature.idaho.gov/statutesrules.htm
6518	ID	License Exemptions for Biodiesel Production for Personal Use	State Incentives			EXEM	
6331	IL	Advanced Vehicle Acquisition and Biodiesel Fuel Use Requirement	Laws and Regulations				http://www.ilga.gov/|http://www.ilga.gov/|http://www.ilga.gov/legislation/ilcs/ilcs.asp

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
4368	IL	Alternative Fuel Vehicle (AFV) and Alternative Fuel Rebates	State Incentives			RBATE	
5698	IL	Alternative Fuel Vehicle (AFV) Fleet Incentives	State Incentives			OTHER	
6329	IL	Alternative Fuels Labeling Requirement	Laws and Regulations				
5993	IL	Biodiesel Blend Use Requirement	Laws and Regulations				
8906	IL	Biodiesel Definition and Specification	Laws and Regulations				
6328	IL	Biodiesel Production Tax	Laws and Regulations				
5697	IL	Biodiesel Tax Exemption	State Incentives		2018-12-13 00:00:00 UTC	EXEM	
11507	IL	Biofuels Business Planning Grants	State Incentives			GNT	
6485	IL	Biofuels Education and Promotion	Laws and Regulations				
5699	IL	Biofuels Preference for State Vehicle Procurement	Laws and Regulations				
11022	IL	Biofuels Production Facility Grants	State Incentives			GNT	
6623	IL	Fuel-Efficient Vehicle Acquisition Goals	Laws and Regulations				http://www.illinois.gov/Government/ExecOrders/Pages/default.aspx
8905	IL	School Bus Retrofit Reimbursement	State Incentives			RBATE	
6330	IL	State Government Energy Initiative	Laws and Regulations				
10938	IN	Alternative Fuel and Special Fuel Definitions	Laws and Regulations				http://www.in.gov/legislative/|http://www.in.gov/legislative/ic/code/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
10936	IN	Alternative Fuel Motor Carrier Fuel Tax	Laws and Regulations				http://www.in.gov/legislative/ic/code/
10937	IN	Alternative Fuel Tax Exemption for Public Transportation	State Incentives		2017-12-31 00:00:00 UTC	TAX	http://www.in.gov/legislative/ic/code/
6222	IN	Biodiesel Blend Tax Exemption	State Incentives			TAX	http://www.in.gov/legislative/ic/code/
5716	IN	Biodiesel Blending Tax Credit	State Incentives			TAX	http://www.in.gov/legislative/ic/code/
6036	IN	Biodiesel Definition	Laws and Regulations				http://www.in.gov/legislative/ic/code/
4402	IN	Biodiesel Price Preference	State Incentives			OTHER	http://www.in.gov/legislative/ic/code/
5715	IN	Biodiesel Production Tax Credit	State Incentives			TAX	http://www.in.gov/dor/3512.htm
5877	IN	Biofuels Blend Use Requirement	Laws and Regulations				http://www.in.gov/legislative/ic/code/
5200	IN	Certified Technology Park Designation	Laws and Regulations				http://www.in.gov/legislative/ic/code/
10794	IN	Community Alternative Fuel Vehicle (AFV) Fleet Grants	State Incentives			GNT	
10795	IN	Diesel Vehicle Retrofit and Improvement Grants	State Incentives			GNT	
10935	IN	Special Fuel Tax	Laws and Regulations				http://www.in.gov/legislative/ic/code/
6219	IN	Vehicle Research and Development Grants	State Incentives			GNT	http://www.in.gov/legislative/ic/code/
5169	KS	Alternative Fuel Vehicle (AFV) Tax Credit	State Incentives			TAX	http://www.kslegislature.org/li/statute/
5171	KS	Alternative Fueling Infrastructure Tax Credit	State Incentives			TAX	http://www.kslegislature.org/li/statute/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6543	KS	Biodiesel and Renewable Fuel Definitions	Laws and Regulations				http://www.kslegislature.org/li/statute/
6059	KS	Biodiesel Production Incentive	State Incentives			RBATE	http://www.kslegislature.org/li/statute/
8304	KS	Biofuel Blending Equipment Tax Exemption	State Incentives			EXEM|TAX	http://www.kslegislature.org/li/statute/
5756	KS	Biofuels Use Requirement	Laws and Regulations				http://www.kslegislature.org/li/statute/
6201	KS	Renewable Fuel Retailer Tax Incentive	State Incentives			TAX	http://www.kslegislature.org/li/statute/|http://www.kslegislature.org/li/
10741	KY	Alternative Fuel and Conversion Definitions	Laws and Regulations				
6294	KY	Alternative Fuel Production Tax Incentives	State Incentives			TAX	http://www.lrc.ky.gov/
6296	KY	Alternative Fuel Research, Development, and Promotion	State Incentives			GNT	http://lrc.ky.gov/krs/titles.htm
5831	KY	Biodiesel Production and Blending Tax Credit	State Incentives			TAX	http://lrc.ky.gov/krs/titles.htm
8281	KY	Biomass and Biofuels Industry Development	Laws and Regulations				http://apps.sos.ky.gov/executive/journal/(S(q5gd4e45idwizi45wea1ti55))/journal2.aspx
10743	KY	Clean Transportation Fuels for School Buses	Laws and Regulations				http://lrc.ky.gov/krs/titles.htm
10738	KY	On-Farm Biofuel Production Grants	State Incentives			GNT	
10740	KY	Request to Report Research on Second Generation Biofuels	Laws and Regulations				http://www.lrc.ky.gov/legislation.htm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6051	KY	State Energy Plan Alternative Fuel Requirements	Laws and Regulations				http://lrc.ky.gov/krs/titles.htm
6297	KY	Vehicle Acquisition Priorities and Alternative Fuel Use Requirement	Laws and Regulations				http://lrc.ky.gov/krs/titles.htm
6603	LA	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Tax Credit	State Incentives			TAX	http://www.legis.la.gov/legis/home.aspx|http://doa.louisiana.gov/osr/lac/lac.htm|http://www.legis.state.la.us/
5972	LA	Biodiesel Equipment and Fuel Tax Exemption	State Incentives		2015-06-30 00:00:00 UTC	TAX|EXEM	http://www.legis.state.la.us/
6104	LA	Biofuels Feedstock Requirements	Laws and Regulations				http://www.legis.state.la.us/
8420	LA	Compressed Natural Gas (CNG) Project Loans	State Incentives			LOANS	http://www.legis.state.la.us/
6604	LA	Provision for Green Jobs Tax Credit	Laws and Regulations			TAX	http://www.legis.state.la.us/
6103	LA	Renewable Fuel Standard	Laws and Regulations				http://www.legis.state.la.us/
10536	MA	Alternative Fuel Offering Requirement	Laws and Regulations				http://www.malegislature.gov/Laws/SessionLaws/Search|http://www.malegislature.gov/Laws/GeneralLaws/
6467	MA	Biodiesel Blend Mandate	Laws and Regulations				http://www.malegislature.gov/Laws/GeneralLaws/
6270	MA	State Agency Alternative Fuel Use Requirement	Laws and Regulations				http://www.mass.gov/anf/budget-taxes-and-procurement/admin-bulletins/
6468	MA	State Hybrid Electric (HEV) Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				htthttp://www.mass.gov/anf/budget-taxes-and-procurement/admin-bulletins/|http://www.malegislature.gov/Laws/GeneralLaws/|http://www.lawlib.state.ma.us/source/mass/eo/index.html

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8979	MA	Voluntary Biofuels Program	Laws and Regulations				
6053	MD	Alternative Fuel Use Requirement	Laws and Regulations				http://mgaleg.maryland.gov/webmga/frm1st.aspx?tab=home|http://www.dbm.maryland.gov/agencies/Documents/FleetManagementServices/fleet_mgmt_manual.pdf
5834	MD	Biofuels Production Incentive	State Incentives			TAX	http://mgaleg.maryland.gov/webmga/frm1st.aspx?tab=home
5297	ME	Alternative Fuel Tax Rates	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
6600	ME	Biodiesel Fuel Tax Exemption	State Incentives			EXEM|TAX	http://www.mainelegislature.org/legis/statutes/
11481	ME	Biodiesel-Blended Diesel Documentation Requirement	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
5757	ME	Biofuels Production Tax Credit	State Incentives			TAX	http://www.mainelegislature.org/legis/statutes/
5729	ME	Provision for Establishment of Clean Fuel Vehicle Insurance Incentives	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
9401	ME	State Plan to Reduce Petroleum Consumption	Laws and Regulations				http://www.mainelegislature.org/legis/statutes/
5769	MI	Alternative Fuel Development Property Tax Exemption	State Incentives			EXEM|TAX	http://www.legislature.mi.gov/(S(kovblajtbo3pwn22ekizx255))/mileg.aspx?page=home
6124	MI	Biodiesel Retail and Storage Requirements	Laws and Regulations				http://www.legislature.mi.gov/(S(tdlrlzzi3qi5hrbz00tllh55))/mileg.aspx?page=home
6122	MI	Biofuels Blender Requirements	Laws and Regulations				http://www.legislature.mi.gov/(S(chtz2jui1ekkqu45xjluze55))/mileg.aspx?page=home
5452	MN	Biodiesel Blend Mandate	Laws and Regulations				http://www.leg.state.mn.us/leg/legis.aspx|https://www.revisor.mn.gov/pubs/
6237	MN	Biodiesel Definition	Laws and Regulations				http://www.leg.state.mn.us/leg/legis.aspx|https://www.revisor.mn.gov/pubs/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6093	MN	Biofuel Blend Mandate	Laws and Regulations				http://www.leg.state.mn.us/|https://www.revisor.mn.gov/pubs/
6094	MN	Biofuel Use Requirement	Laws and Regulations				http://www.leg.state.mn.us/lrl/execorders/execorders.aspx|http://www.leg.state.mn.us/leg/legis.aspx
10984	MN	NextGen Energy Board	Laws and Regulations				http://www.leg.state.mn.us/leg/legis.aspx|https://www.revisor.mn.gov/pubs/
9399	MN	State Agency Sustainability Plan and Requirements	Laws and Regulations				http://www.leg.state.mn.us/leg/legis.aspx|http://www.leg.state.mn.us/lrl/execorders/execorders.aspx|https://www.revisor.mn.gov/pubs/
4538	MO	Alternative Fuel Promotion	Laws and Regulations				http://www.moga.mo.gov/
5253	MO	Alternative Fuel Vehicle (AFV) Acquisition and Alternative Fuel Use Requirements	Laws and Regulations				http://www.moga.mo.gov/
5607	MO	Alternative Fuel Vehicle (AFV) Decal	Laws and Regulations				http://www.moga.mo.gov/|http://www.moga.mo.gov/
6450	MO	Alternative Fueling Infrastructure Tax Credit	State Incentives		2018-01-01 00:00:00 UTC	TAX	http://www.moga.mo.gov/|http://www.moga.mo.gov/
5604	MO	Biodiesel Use Requirement	Laws and Regulations				http://www.moga.mo.gov/
11553	MO	State Energy Plan	Laws and Regulations				http://governor.mo.gov/news/executive-orders
5252	MO	State Fleet Biodiesel Fuel Use	Laws and Regulations			GNT	http://www.moga.mo.gov/
10792	MS	Alternative Fuel Vehicle Revolving Loan Program	State Incentives			LOANS	http://www.lexisnexis.com/hottopics/mscode/
8310	MS	Biodiesel and Renewable Diesel Definitions, Registration, and Labeling Requirements	Laws and Regulations				http://www.mdac.state.ms.us/agency/regulations_laws/reg_ pdfs/Subpart 4/08 - Petroleum Products Inspection Law.pdf

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5556	MS	Biofuels Production Incentive	State Incentives		2015-06-30 00:00:00 UTC	GNT	http://www.lexisnexis.com/hottopics/mscode/
6049	MS	Fuel-Efficient and Alternative Fuel Vehicle Use	Laws and Regulations				http://www.lexisnexis.com/hottopics/mscode/
6196	MT	Alternative Fuel Production Property Tax Incentive	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
4547	MT	Alternative Fuel Vehicle (AFV) Conversion Tax Credit	State Incentives			TAX	
5861	MT	Biodiesel Blending Tax Credit	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
5862	MT	Biodiesel Production Facility Tax Credit	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
6555	MT	Biodiesel Tax Exemption	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
6502	MT	Biodiesel Tax Refund	State Incentives			TAX	http://leg.mt.gov/bills/mca_toc/index.htm
5986	NC	Alternative Fuel and Alternative Fuel Vehicle (AFV) Fund	State Incentives			GNT	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
5294	NC	Alternative Fuel and Idle Reduction Grants	State Incentives			GNT	
5664	NC	Alternative Fuel Tax Exemption	State Incentives			TAX|EXEM	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
5988	NC	Alternative Fuel Use and Fuel-Efficient Vehicle Requirements	Laws and Regulations				
5484	NC	Alternative Fuel Vehicle (AFV) Acquisition Goal	Laws and Regulations				http://www.ncleg.net/gascripts/Statutes/Statutes.asp

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6195	NC	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Support	State Incentives			GNT	
10412	NC	Alternative Fuels Feasibility Study	Laws and Regulations				http://www.ncga.state.nc.us/
6285	NC	Biodiesel Requirement for School Buses	Laws and Regulations				http://www.ncleg.net/gascripts/Statutes/Statutes.asp
6286	NC	Biodiesel Tax Exemption	State Incentives			EXEM|TAX	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
6284	NC	Biodiesel Warranty Requirement	Laws and Regulations				http://www.ncleg.net/gascripts/Statutes/Statutes.asp
6281	NC	Bond Exemption for Small Biofuels Suppliers	State Incentives			EXEM	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
5483	NC	Renewable Energy Property Tax Credit	State Incentives		2016-01-01 00:00:00 UTC	TAX	http://www.ncleg.net/gascripts/Statutes/Statutes.asp
6550	ND	Advanced Biofuel Incentives	State Incentives			LOANS|GNT	http://www.legis.nd.gov/general-information/north-dakota-century-code
8484	ND	Agriculturally-Based Fuel Production Wage and Salary Tax Credit	State Incentives			TAX	http://www.legis.nd.gov/general-information/north-dakota-century-code
9299	ND	Agriculturally-Derived Fuel Production Facility Loan Guarantees	State Incentives			LOANS	http://www.legis.nd.gov/general-information/north-dakota-century-code
6234	ND	Alternative Fuel Labeling Requirement	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code
5869	ND	Alternative Fuel Tax Rates	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code
9300	ND	Biodiesel and Green Diesel Definitions	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5865	ND	Biodiesel Blender Tax Credit	State Incentives			TAX	http://www.legis.nd.gov/general-information/north-dakota-century-code
6170	ND	Biodiesel Production and Blending Equipment Tax Credit	State Incentives			TAX	http://www.legis.nd.gov/general-information/north-dakota-century-code
5576	ND	Biodiesel Sales Equipment Tax Credit	State Incentives			TAX	http://www.legis.nd.gov/general-information/north-dakota-century-code
5866	ND	Biofuel Loan Program	State Incentives			LOANS	http://www.legis.nd.gov/general-information/north-dakota-century-code
6231	ND	Renewable Fuels Promotion	Laws and Regulations				http://www.legis.nd.gov/general-information/north-dakota-century-code
5964	NE	Alternative Fuel Use	Laws and Regulations				http://nlc1.nlc.state.ne.us/docs/pilot/pubs/EOIndex.html
4557	NE	Biodiesel Production Investment Tax Credit	State Incentives			TAX	http://nebraskalegislature.gov/laws/browse-statutes.php
5735	NE	Ethanol and Biodiesel Tax Exemption	State Incentives			EXEM|TAX	http://nebraskalegislature.gov/laws/browse-statutes.php
10421	NH	Alternative Fuels Taxation Study Commission	Laws and Regulations				http://www.gencourt.state.nh.us/
6473	NH	Biodiesel Blend Purchase Requirement	Laws and Regulations				http://www.gencourt.state.nh.us/rsa/html/indexes/default.html
6100	NH	Biodiesel Definition	Laws and Regulations				http://www.gencourt.state.nh.us/rsa/html/indexes/default.html
6618	NH	Biodiesel Distributor License and Recordkeeping Requirements	Laws and Regulations				http://gencourt.state.nh.us/rsa/html/indexes/default.html
11101	NH	State Energy Strategy Development	Laws and Regulations				http://www.gencourt.state.nh.us/
9593	NJ	Biofuel Use Requirements	Laws and Regulations				

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
11200	NJ	Biofuels Promotion	Laws and Regulations				http://www.njleg.state.nj.us/
5493	NJ	Low Emission or Alternative Fuel Bus Acquisition Requirement	Laws and Regulations				http://lis.njleg.state.nj.us/cgi-bin/om_isapi.dll?clientID=109559&depth=2&expandheadings=off&headingswithhits=on&infobase=statutes.nfo&softpage=TOC_Frame_Pg42
5391	NM	Alternative Fuel Definition	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
9053	NM	Alternative Fuel Tax Exemption	State Incentives			TAX|EXEM	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
4600	NM	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants	State Incentives			GNT	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
4605	NM	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Acquisition Requirements	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
4607	NM	Alternative Fuels Tax	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx|http://www.nmlegis.gov/lcs/default.aspx
6181	NM	Biodiesel Blend Mandate	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
11300	NM	Biodiesel Blending Facility Loading Fee Deduction	State Incentives			TAX	http://www.nmlegis.gov/lcs/default.aspx
9052	NM	Biodiesel Blending Facility Tax Credit	State Incentives			TAX	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
10652	NM	Biodiesel Tax Deduction	State Incentives			TAX	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
5826	NM	Biofuels Production Tax Deduction	State Incentives			TAX	http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx
6522	NM	Green Jobs Training Program	Laws and Regulations				http://www.nmonesource.com/nmnxtadmin/NMPublic.aspx

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5266	NV	Alternative Fuel Vehicle (AFV) Acquisition Requirement	Laws and Regulations				http://www.leg.state.nv.us/law1.cfm
6597	NV	Biodiesel Producer Requirements	Laws and Regulations				http://www.leg.state.nv.us/|http://www.leg.state.nv.us/law1.cfm
11060	NV	Biodiesel Sales Requirements	Laws and Regulations				http://www.leg.state.nv.us/|http://www.leg.state.nv.us/law1.cfm
6251	NV	Funds for School District Alternative Fuel Use	Laws and Regulations				http://www.leg.state.nv.us/law1.cfm
5263	NV	Provision for Establishment of Alternative Fuel Incentives	Laws and Regulations				http://www.leg.state.nv.us/law1.cfm
5328	NY	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.ogs.state.ny.us/purchase/spg/pdfdocs/EO142_EEP.pdf|http://www.dec.ny.gov/energy/71389.html|http://www.potsdam.edu/about/sustainability/links/upload/EO111.pdf
5325	NY	Alternative Fuel Vehicle Research and Development Funding	State Incentives			GNT|OTHER	
6302	NY	Biofuel Production Tax Credit	State Incentives		2019-12-31 00:00:00 UTC	TAX	http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS
6109	NY	Fuel Exclusivity Contract Regulation	Laws and Regulations				http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS
6024	OH	Alternative Fuel and Fueling Infrastructure Incentives	State Incentives			GNT	http://codes.ohio.gov/|http://www.legislature.state.oh.us/
8980	OH	Alternative Fuel Signage	Laws and Regulations				http://codes.ohio.gov/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6164	OH	Alternative Fuel Vehicle (AFV) Acquisition and Fuel Use Requirements	Laws and Regulations				http://www.dsireusa.org/documents/Incentives/EO2007-02S.pdf|http://www.legislature.state.oh.us/|http://www.afdc.energy.gov/laws/laws/ http:/codes.ohio.gov/
5338	OH	Alternative Fuel Vehicle Conversion	Laws and Regulations				http://www.afdc.energy.gov/laws/laws/ http:/codes.ohio.gov/
6501	OH	School Bus Retrofit Grant Program	State Incentives			GNT	
6561	OK	Access to State Alternative Fueling Stations	Laws and Regulations				http://www.oklegislature.gov/
11047	OK	Alternative Fuel School Bus Conversion Research	Laws and Regulations				https://www.sos.ok.gov/gov/execorders.aspx
5216	OK	Alternative Fuel Technician Training	Laws and Regulations				http://www.oklegislature.gov/
5612	OK	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.oklegislature.gov/
4668	OK	Alternative Fuel Vehicle (AFV) Low-Interest Loans	State Incentives			LOANS	
8523	OK	Biodiesel Definition and Specifications	Laws and Regulations				http://www.oklegislature.gov/
11045	OK	Biofuels Construction and Permitting Assistance	State Incentives			OTHER	
6242	OK	Biofuels Tax Exemption	State Incentives			EXEM	http://www.oklegislature.gov/
4684	OR	Alternative Fuel Loans	State Incentives			LOANS	http://www.leg.state.or.us/ors/home.htm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
4688	OR	Alternative Fuel Vehicle (AFV) Acquisition, Fuel Use, and Emissions Reductions Requirements	Laws and Regulations				http://www.leg.state.or.us/ors/home.htm|http://governor.oregon.gov/Gov/exec_orders.shtml
9555	OR	Alternative Fuel Vehicle (AFV) and Infrastructure Tax Credit for Businesses	State Incentives			TAX	http://www.leg.state.or.us/ors/home.htm
11063	OR	Alternative Fuel Vehicle (AFV) Loan Program	State Incentives			LOANS	http://www.leg.state.or.us/|http://www.leg.state.or.us/ors/home.htm
6275	OR	Biodiesel Quality Testing Procedures	Laws and Regulations				http://www.leg.state.or.us/ors/home.htm
11062	OR	Biodiesel Tax Exemption	State Incentives			TAX	http://www.leg.state.or.us/ors/home.htm
6273	OR	Biofuels Production Property Tax Exemption	State Incentives			TAX	http://www.leg.state.or.us/ors/home.htm
6276	OR	Biofuels Program Impact Studies	Laws and Regulations		2025-01-01 00:00:00 UTC		http://www.leg.state.or.us/ors/home.htm
6606	OR	Clean Transportation Fuel Standards	Laws and Regulations				http://sos.oregon.gov/archives/Pages/oregon_administrative_rules.aspx|http://www.leg.state.or.us/ors/home.htm
6274	OR	Renewable Fuels Mandate	Laws and Regulations				http://arcweb.sos.state.or.us/banners/rules.htm|http://www.leg.state.or.us/
6324	PA	Alternative Fuel Development and Deployment Grants	State Incentives			GNT	
5812	PA	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Funding	State Incentives			GNT|RBATE	
5376	PA	Alternative Fuels Tax	Laws and Regulations				

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6486	PA	Renewable Fuels Mandate	Laws and Regulations				
5970	RI	Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Acquisition Requirements	Laws and Regulations				http://www.afdc.energy.gov/pdfs/Exec_order_5_13_green_clean_vehicles.pdf
5764	RI	Biodiesel Tax Exemption	State Incentives			EXEM|TAX	http://webserver.rilin.state.ri.us/Statutes/
11523	RI	State Agency Coordination to Address Climate Change	Laws and Regulations				http://webserver.rilin.state.ri.us/legislation/|http://webserver.rilin.state.ri.us/Statutes/
11516	SC	Alternative Fuel School Bus Pilot Program	State Incentives		2015-06-01 00:00:00 UTC	LOANS|OTHER	http://www.scstatehouse.gov/index.php
11518	SC	Alternative Fuel Vehicle (AFV) Revolving Loan Program for Private Entities	State Incentives			LOANS	http://www.scstatehouse.gov/code/statmast.php
11517	SC	Alternative Fuel Vehicle (AFV) Revolving Loan Program for Public Entities	State Incentives			LOANS	http://www.scstatehouse.gov/code/statmast.php
6264	SC	Biodiesel Blend Distribution Mandate	Laws and Regulations				http://www.scstatehouse.gov/code/statmast.php
6267	SC	Biodiesel Use in School Buses	Laws and Regulations				http://www.scstatehouse.gov/code/statmast.php
8561	SC	Biofuel Blending Capability Requirements and Liability	Laws and Regulations				http://www.scstatehouse.gov/code/statmast.php
6262	SC	Biofuels Distribution Infrastructure Tax Credit	State Incentives			TAX	http://www.scstatehouse.gov/code/statmast.php

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
6263	SC	Biofuels Production Facility Tax Credit	State Incentives			TAX	http://www.scstatehouse.gov/code/statmast.php
11520	SC	Clean Energy Advisory Commission	State Incentives			OTHER	http://www.scstatehouse.gov/code/statmast.php|http://www.scstatehouse.gov/index.php
6458	SC	State Agency Preference for Alternative Fuel and Advanced Vehicles	Laws and Regulations				http://www.scstatehouse.gov/code/statmast.php
6520	SD	Biodiesel Blend Tax Credit	State Incentives			TAX	http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6037	SD	Biodiesel Fuel Use	Laws and Regulations				
5720	SD	Biodiesel Tax	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
9193	SD	Biofuel Franchising Contract Regulations	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6189	SD	Fuel Quality Standards	Laws and Regulations				http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6523	SD	Tax Refund for Methanol Used in Biodiesel Production	State Incentives			RBATE|TAX	http://legis.sd.gov/Statutes/Codified_Laws/default.aspx
6245	TN	Alternative Fuel and Fuel-Efficient Vehicle Acquisition and Use Requirements	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/|http://www.capitol.tn.gov/|http://www.state.tn.us/sos/pub/execorders/index.htm
6435	TN	Biodiesel and Ethanol Definitions and Retail Requirements	Laws and Regulations				http://www.tennessee.gov/sos/rules/0080/0080.htm
8501	TN	Biofuel Blending Contract Regulation	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
6061	TN	Biofuel Fueling Infrastructure Grants	State Incentives			GNT	http://www.lexisnexis.com/hottopics/michie/|http://www.state.tn.us/sos/pub/execorders/index.htm
6436	TN	Biofuels Production Promotion	Laws and Regulations				http://www.legislature.state.tn.us/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5961	TN	Biofuels Quality Specifications	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
6434	TN	Energy Task Force	Laws and Regulations				http://www.state.tn.us/sos/pub/execorders/index.htm
6574	TN	Supply of Petroleum Products for Blending with Biofuels	Laws and Regulations				http://www.lexisnexis.com/hottopics/michie/
6585	TX	Alternative Fuel Use and Vehicle Acquisition Requirements	Laws and Regulations				http://www.statutes.legis.state.tx.us/
9456	TX	Alternative Fueling Infrastructure Grants	State Incentives			GNT	http://www.statutes.legis.state.tx.us/|http://www.sos.state.tx.us/tac/index.shtml/
11499	TX	Clean School Bus Program	State Incentives			GNT	http://www.sos.state.tx.us/tac/index.shtml/
5309	TX	Clean Vehicle and Infrastructure Grants	State Incentives			GNT	http://www.statutes.legis.state.tx.us/
5641	TX	Diesel Fuel Blend Tax Exemption	State Incentives			EXEM|TAX	http://www.statutes.legis.state.tx.us/
6586	TX	Renewable Fuel Promotion	Laws and Regulations				http://www.statutes.legis.state.tx.us/
11401	UT	Alternative Fuel Use and Vehicle Acquisition Requirement	Laws and Regulations				http://le.utah.gov/xcode/code.html
4764	UT	Provision for Establishment of Alternative Fuel Use Mandate	Laws and Regulations				http://le.utah.gov/xcode/code.html
10492	VA	Agriculture and Forestry Biofuel Production Grants	State Incentives			GNT	http://lis.virginia.gov/000/src.htm
4789	VA	Alternative Fuel and Vehicle Tax	Laws and Regulations				http://lis.virginia.gov/000/src.htm|http://virginiageneralassembly.gov/
4796	VA	Alternative Fuel License	Laws and Regulations				http://lis.virginia.gov/000/src.htm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
10674	VA	Alternative Fuel Tax Exemption	State Incentives			EXEM|TAX	http://lis.virginia.gov/000/src.htm
4781	VA	Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Loans	State Incentives			LOANS	http://lis.virginia.gov/000/src.htm
9853	VA	Alternative Fuel Vehicle (AFV) Conversion Fund	Laws and Regulations				http://virginiageneralassembly.gov/|http://lis.virginia.gov/000/src.htm
5514	VA	Alternative Fuel Vehicle (AFV) Signs for School Buses	Laws and Regulations				http://lis.virginia.gov/000/src.htm
8242	VA	Biodiesel and Green Diesel Fuel Use Requirement	Laws and Regulations				http://www.governor.virginia.gov/PolicyOffice/ExecutiveOrders/|http://lis.virginia.gov/000/src.htm
6359	VA	Biodiesel Production Tax Credit	State Incentives			TAX	http://lis.virginia.gov/000/src.htm
8241	VA	Biofuel Feedstock Registration Exemption	State Incentives			EXEM	http://lis.virginia.gov/000/src.htm
6360	VA	Biofuels and Green Diesel Definitions	Laws and Regulations				http://lis.virginia.gov/000/src.htm
6046	VA	Biofuels Production Grants	State Incentives			GNT	http://virginiageneralassembly.gov/|http://lis.virginia.gov/000/src.htm
10673	VA	Clean Energy Manufacturing Grants	State Incentives			GNT	http://lis.virginia.gov/000/src.htm
11301	VA	Clean Transportation Technology Investment Funding	State Incentives			OTHER	
6065	VA	State Energy Plan	Laws and Regulations				http://virginiageneralassembly.gov/|http://lis.virginia.gov/000/src.htm
5622	VT	Alternative Fuel and Advanced Vehicle Research and Development Tax Credit	State Incentives			TAX	http://www.leg.state.vt.us/statutesMain.cfm

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5625	VT	Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.leg.state.vt.us/statutesMain.cfm
10295	VT	Alternative Fuel Vehicle (AFV) User Fee Study	Laws and Regulations				http://www.leg.state.vt.us/
10940	VT	School Bus Pilot Program	State Incentives			OTHER	http://www.leg.state.vt.us/statutesMain.cfm
5754	VT	State Agency Energy Plan Transportation Requirements	Laws and Regulations				http://www.leg.state.vt.us/statutes/fullchapter.cfm?Title=03APPENDIX&Chapter=010|http://www.leg.state.vt.us/statutesMain.cfm
6214	WA	Alternative Fuel Use Requirement	Laws and Regulations				http://apps.leg.wa.gov/rcw/|http://apps.leg.wa.gov/wac/
6211	WA	Biodiesel Definition	Laws and Regulations				http://apps.leg.wa.gov/rcw/
8261	WA	Biodiesel Feedstock Tax Exemption	State Incentives			TAX|EXEM	http://apps.leg.wa.gov/rcw/
5722	WA	Biodiesel Storage Regulations	Laws and Regulations				http://apps.leg.wa.gov/wac/
6041	WA	Biodiesel Use Requirement	Laws and Regulations				http://apps.leg.wa.gov/rcw/
6537	WA	Biofuel Blend Dispenser Labeling Requirement	Laws and Regulations				http://apps.leg.wa.gov/wac/|http://apps.leg.wa.gov/rcw/
6410	WA	Biofuel Quality Program	Laws and Regulations				http://apps.leg.wa.gov/rcw/
9396	WA	Biofuel Volume Rebate Program - Propel Fuels	Utility/Private Incentives			RBATE	
6208	WA	Biofuels Distribution Tax Exemption	State Incentives		2015-07-01 00:00:00 UTC	EXEM|TAX	http://apps.leg.wa.gov/rcw/
6213	WA	Biofuels Production and Distribution Contracts	Laws and Regulations				http://apps.leg.wa.gov/rcw/

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
5721	WA	Biofuels Production Tax Exemption	State Incentives		2015-12-31 00:00:00 UTC	TAX|EXEM	http://apps.leg.wa.gov/rcw/
5580	WA	Biofuels Tax Deduction	State Incentives		2015-07-01 00:00:00 UTC	TAX	http://apps.leg.wa.gov/rcw/
6530	WA	Clean and Efficient Fleet Assistance	Utility/Private Incentives			OTHER	
6535	WA	Provision for Alternative Fuels Corridor Pilot Projects	Laws and Regulations				http://apps.leg.wa.gov/rcw/|http://www.governor.wa.gov/office/execorders/default.aspx
6040	WA	Renewable Fuel Standard	Laws and Regulations				http://apps.leg.wa.gov/rcw/
6217	WA	State Emissions Reductions Requirements	Laws and Regulations				http://www.governor.wa.gov/office/execorders/eoarchive/default.aspx|http://apps.leg.wa.gov/rcw/
9977	WA	State Vehicle Purchasing Guidance	Laws and Regulations				http://apps.leg.wa.gov/rcw/
5336	WI	Alternative Fuel License	Laws and Regulations				http://www.legis.state.wi.us/rsb/stats.html
5334	WI	Alternative Fuel Tax Exemption	State Incentives			EXEM	http://legis.wisconsin.gov/rsb/stats.html
4841	WI	Alternative Fuel Vehicle Acquisition and Alternative Fuel Use Requirements	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
8975	WI	Alternative Fueling Infrastructure Development	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
6158	WI	Biodiesel Definition	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
6021	WI	Biodiesel Fuel Use Incentive	State Incentives			GNT	http://legis.wisconsin.gov/rsb/stats.html
6022	WI	Biodiesel Labeling Requirement	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html

Law Id	State	Title	Type	Agency	Expired Date	Incentive Categories	References
8974	WI	Petroleum Reduction Requirements	Laws and Regulations				http://docs.legis.wisconsin.gov/code/executive_orders/2003_jim_doyle/2006-141.pdf|http://legis.wisconsin.gov/rsb/stats.html
6475	WI	Renewable Fuel Infrastructure Tax Credit	State Incentives			TAX	http://legis.wisconsin.gov/rsb/stats.html
8972	WI	Renewable Fuel Producer Excise Tax and Inspection Exemption	State Incentives			TAX|EXEM	http://legis.wisconsin.gov/rsb/stats.html
8976	WI	Renewable Fuel Sales Volume Goals	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
8978	WI	Sustainable Biofuels Production Practices	Laws and Regulations				http://legis.wisconsin.gov/rsb/stats.html
4823	WV	Alternative Fuel Production Subsidy Prohibition	Laws and Regulations				
6176	WV	Alternative Fuel School Bus Incentive	State Incentives			RBATE	http://www.legis.state.wv.us/WVCODE/Code.cfm
9154	WV	Alternative Fuel Use Requirement	Laws and Regulations				http://www.legis.state.wv.us/WVCODE/Code.cfm
10712	WV	Alternative Fuels Tax	Laws and Regulations				http://www.legis.state.wv.us/WVCODE/Code.cfm
5392	WV	Provision for Establishment of Alternative Fuel Vehicle (AFV) Acquisition Requirements	Laws and Regulations				http://www.legis.state.wv.us/WVCODE/Code.cfm

Source: Department of Energy, Energy Efficiency & Renewable Energy, Alternative Fuels Data Center
http://www.afdc.energy.gov/data_download/

Appendix E

Listening Session Agenda

Biomass Sorghum and Sweet Sorghum – FCIC Insurance? Listening Session Agenda

- Introductions
  - Watts and Associates, Inc.
  - Attendees

- Purpose
  - Gather stakeholder input regarding possible Federal crop insurance coverage for "biomass sorghum and sweet sorghum that is grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or bio-based products."

- Background
  - Paperwork Reduction Act Constraints
  - Farm Bill Mandate
  - Contract Requirements

- Stakeholder Input
  - Size of Industry
  - Commodity Pricing – Contracted, Grain Sorghum plus Premium
  - Contract Terms
  - Type of Insurance Interests
  - Demand from Biofuels Industry for Crop
  - Natural Risks and Industry Response
  - Production Risks Associated with Crop and Mitigation Options
  - Financial Risks Associated with Crop and Mitigation Options
  - Other issues raised by the attendees

- Questions

Appendix F

Biomass Sorghum and Sweet Sorghum Listening Session Press Release

Government Contractor Seeks Stakeholder Input on Federal Insurance for Biomass Sorghum and Sweet Sorghum.

In the Agricultural Act of 2014, an amendment to Section 522(c) of the Federal Crop Insurance Act was made. One portion of the amendment added a subparagraph to that Act directing the Federal Crop Insurance Corporation to contract "with qualified entities to carry out development regarding a policy to insure biomass sorghum and sweet sorghum that is grown expressly for the purposes of producing a feedstock for renewable biofuel, renewable electricity, or biobased products." Watts and Associates, Inc. (W&A) was contracted to conduct a nationwide study to determine the feasibility of developing a crop insurance product for these crops followed by a potential development effort based on the feasibility recommendation, and direction from the government. W&A, an economic consulting firm out of Billings Montana, has completed almost 100 contracts focused on crop insurance over the last 12 years. Part of the required research is gathering stakeholder input. To that end, W&A is conducting listening sessions in Garden City, Kansas on March 10, 2015 (Hampton Inn, 2505 Crestway Dr., Garden City, KS – 10:00 am); Fort Pierce, Florida on March 12, 2015 (Hampton Inn & Suites, 1985 Reynolds Dr., Fort Pierce, FL – 9:00 am); Modesto, California on March 17, 2015 (Stanislaus County Harvest Hall, 3800 Cornucopia Way, Modesto, CA – 2:00 pm); and Marksville, Louisiana on March 19, 2015 (Hampton Inn & Suites, 6896 HWY 1, Mansura, LA – 9:00 am). W&A is interested in any information on the level of interest in crop insurance the biomass sorghum and sweet sorghum industry holds, risk management techniques the industry currently uses, how pricing for the crop is determined by the industry, and other relevant feedback. W&A is interested in having a conversation with producers, extension agents, crop insurance industry representatives, and bio-energy industry representatives – the stakeholders. If you are unable to attend, you can provide your input to Richard Allen at W&A by email at rallen@wattsandassociates.com.

Appendix G

Production of Biofuel Crops in Florida: Sweet Sorghum and Forage Sorghum (Sorghum bicolor): Overview and Management

UF UNIVERSITY of FLORIDA
IFAS Extension

SS-AGR-293

Production of Biofuel Crops in Florida: Sweet Sorghum[1]

Wilfred Vermerris, John Erickson, David Wright, Yoana Newman, and Curtis Rainbolt[2]

Introduction

The term 'sweet sorghum' is used to describe varieties of sorghum (*Sorghum bicolor* (L.) Moench), a summer annual, which have a high concentration of soluble sugars in the plant sap or juice. This crop is attractive because of the easy accessibility of readily fermentable sugars combined with very high yields of green biomass. In all varieties, the primary carbohydrate is sucrose, with variable amounts of reducible sugars and starch. Similar to sugarcane, the sap of sweet sorghum is extracted by milling. Once extracted, the sugars from sweet sorghum can be easily fermented to produce ethanol. Other products from sweet sorghum include syrup, molasses, and crystal sugar.

Current Potential for Use as Biofuel

Sweet sorghums have generated interest as a feedstock for ethanol production since the 1970s. Juice from sweet sorghum can be converted to ethanol using currently available, conventional fermentation technology (similar to ethanol produced from sugarcane juice in Brazil). The bagasse (crushed stalks) that remains after removal of the juice can be burnt to generate electricity or steam as part of a co-generation scheme. Additionally, the bagasse could be utilized as a feedstock if the technology for cellulosic ethanol production becomes viable on a commercial scale.

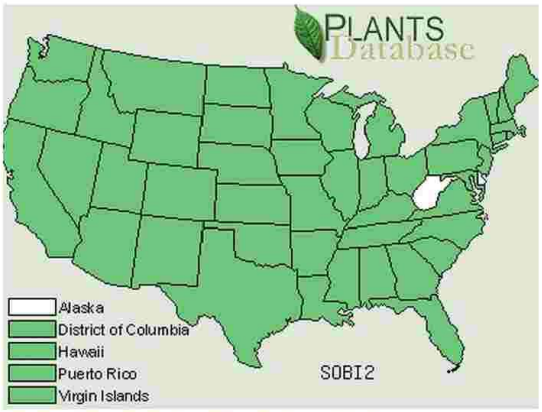

Figure 1. Occurrence of *Sorghum bicolor* in the U.S.

Credits: NRCS Plants Database

Typically, sweet sorghum varieties have low grain yield, but recently varieties with more balanced grain/sugar production have been developed in China and India. These varieties can be used as a dual-purpose crop, where the grain is harvested for human or animal consumption and the sugars are fermented to ethanol. Alternatively, these varieties can be used as a dedicated bioenergy crop, where both the sugars and the grain are used for ethanol production.

1. This document is SS-AGR-293, a publication from the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. This document is one of a series entitled "Production of Biofuel Crops in Florida." Original publication date January 2008. Revised December 2011. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Wilfred Vermerris, associate professor, Agronomy Department; John Erickson, assistant professor, Agronomy Department; David Wright, professor, Agronomy Department, North Florida Research and Education Center, Quincy, FL; Yoana Newman, assistant professor, Agronomy Department; Curtis Rainbolt, former assistant professor, Agronomy Department, Everglades Research and Education Center, Belle Glade, FL; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

Figure 2. Sweet sorghum planted in Florida

Credits: Forage Extension, Agronomy Department

Biology of Sweet Sorghum

Sorghum is an annual crop with considerable variability in growth characteristics. Heights range from 1.5 ft for grain sorghum types to over 16 ft tall for sweet and forage types. The thickness of stalks also varies, ranging between 0.5–1.5 inches. Brace or prop roots often grow from the lower nodes. Juice content of stalks at maturity is typically lower in grain and forage types compared to sweet types. Seeds are produced by self-pollination from a panicle that emerges at the top of the plant and contains both the male and female inflorescences. Sorghum seeds are small, round and may be white, yellow, brown, or red in color. Although sorghum is predominately self-pollinating, hybrids and crosses can be produced using male-sterile plants as the maternal parent. After harvesting the stalks, most varieties will regrow or ratoon. The ability to form a ratoon enables multiple harvests per season in certain environments, although yields typically decrease in ratoon crops. Sugar content in the juice increases with maturity and is low prior to seed development.

Production

Sweet sorghum is a warm-season crop that tolerates drought and high temperatures better than many crops, but it does not grow well under low temperatures. Optimal planting times in Florida will vary between locations, but soil temperatures at planting should be above 65°F. Late planted crops will mature more rapidly, but should be planted early enough to ensure that the crop matures before the first expected killing frost.

Proper variety selection will play a large role in the success of sweet sorghum production for ethanol. The ideal variety for a particular location should produce high yields with minimal inputs, have a high percentage of high quality and easily extractable juice, be disease and insect tolerant, and tolerate both drought and wet conditions.

Sweet sorghum can be produced in a wide variety of soil types, but yields are typically highest in deep, well-drained soils with good fertility. Sorghum grown in shallow soils or soils very low in organic matter may be more prone to drought stress. Although sorghum is more tolerant of drought stress than many other crops, ample moisture during the growing season is important for good yields of stalks and juice.

Soil tests should be taken to determine soil fertility requirements for sweet sorghum. Nitrogen typically has the greatest impact on yields and will likely be needed on most soils. UF/IFAS studies using currently available sweet sorghum varieties (e.g., M 81E) on sandy soils in Florida with low organic matter indicate that optimal sugar yields can be achieved with N fertilization rates between 80–120 lbs nitrogen (N) per acre for a single crop. Best results will be achieved if you apply N in two split applications. These same studies also indicate a crop needs about 40 lbs of P_2O_5 per acre per crop; however, P_2O_5 application rates should also be based on soil test recommendations. Recommended rates for K_2O are 100 lbs per acre per crop for soils with medium fertility levels (see http://edis.ifas.ufl.edu/ss163). Lime should be applied to soils with a pH below 6.0 to correct soil acidity.

Sweet sorghum is typically seeded in widely spaced rows (30–40 inches) using a corn planter. The ideal seeding rate for most sweet sorghum varieties is 3–4 seeds per linear ft of row with a final stand of 2–3 plants per linear ft of row. If plant populations are too high, the canes will be spindly and contain less juice than an equal tonnage of larger diameter canes.

Currently, the only commercially viable harvest method for sweet sorghum is removing the entire crop with a forage harvester and transporting it to a mill/ethanol facility. Using this method, transportation costs and proximity to the mill/ethanol facility will play a large role in determining where sweet sorghum production is profitable. Several research groups have developed prototype harvesters that extract the juice and leave the bagasse in the field, but it is unclear if this technology will become commercially viable.

Risk Management Agency
Order No: D15PX00044

Potential Yields

Sweet sorghum yields vary considerably depending on the cultivars/hybrids used, the location (soil, water, climate, pests, and diseases), inputs, and production practices. When considering sweet sorghum for ethanol production via conventional fermentation, biomass yield, juice yield, and sugar production per acre are the most important yield components. The concentration of soluble sugars in sorghum ranges widely depending upon variety. For example, some forage varieties have some sweet sorghum parental background to increase the palatability and energy value of the feed. While these forage types produce high amounts of biomass and some sucrose, they typically contain much less sucrose than dedicated sweet sorghum types (up to 20%).

UF/IFAS researchers have recently completed sweet sorghum field trials at locations across Florida to address a number of the production-related issues for our region. Plant crop green yields (without grain heads) for 'Dale', 'Topper 76-6', and 'M 81E' sweet sorghum cultivars across three spring planting dates from late March to mid-June averaged 31.3 tons per acre. Brix values (which measure sugar content) averaged about 14.8%, but were lower for all cultivars grown on muck soils in the Everglades Agricultural Area (EAA). We found limited opportunities for 'ratooning' these sweet sorghum cultivars, as ratoon crop yields were generally 1/3 to 1/2 as much as the plant crop yields, even in South Florida. These data resulted in estimated sugar yields of 5,075 lbs per acre (approximately 400 gallons of ethanol per acre) from a single crop.

UF/IFAS data are similar to data collected from multiple sources, with a wide range of genetic variability, production practices, and growing environments. These studies have shown that biomass yields of sweet sorghums can range from 8 to 48 tons per acre and juice content ranges from 65% to 80%. The combined sugar content of the juice varies between 9%–20%. Sugar yields vary from 1.6 to 6.9 tons per acre. The bagasse and leaves make up the remainder of the wet biomass. The bagasse represents approximately two-thirds of the dry matter. Fermentation of the sugar in the juice yields between 400–600 gallons of ethanol per acre.

Production Challenges

The costs associated with transportation of the crop to the mill will be the major limiting factor for where sweet sorghum can be grown profitably. Varieties that have higher sugar contents per ton of biomass will be more efficient to process and haul to the mill.

Currently, there is a limited number of varieties for which seed is commercially available. If sweet sorghum is widely and rapidly adopted as an energy crop, seed may become difficult to obtain. Disease and insect problems may also limit yield potentials because there are no sweet sorghum varieties that have been specifically bred for Florida growing conditions.

Estimated Production Costs

Currently, sweet sorghum is not produced in Florida on a commercial basis, so there is limited information on production costs. However, grain and silage/forage sorghum are produced in North Florida and their production costs are likely similar. Information can be found at http://nfrec.ifas.ufl.edu/programs/enterprise_budgets.shtml#field_crops.

Environmental Concerns

Compared to many other crops, sweet sorghum has high water- and nutrient-use efficiencies and is considered environmentally sustainable. Unlike some proposed high biomass energy crops, sweet sorghum is not a threat to become an invasive weed in Florida.

Summary

It should be noted that there are no commercial facilities converting sweet sorghum to ethanol currently operating in Florida. However, several conversion facilities are in the design, planning, or construction phase. Consequently, growing sweet sorghum for purposes other than research or a green manure crop is not recommended unless you have a legally binding contract with an ethanol facility.

Sources of Additional Information

- Erickson, J.E., Z.R. Helsel, K.R. Woodard, et al. 2011. "Planting Date Affects Biomass and Brix of Sweet Sorghum Grown for Biofuel across Florida." *Agronomy Journal* 103:1827-33.
- Hewitt, T. 2006b. "Estimated Costs of One Acre of Grain Sorghum, North Florida." Accessed December 2, 2011. http://nfrec.ifas.ufl.edu/programs/enterprise_budgets.shtml#field_crops.
- McBee, G.G., R.A. Creelman, and F.R. Miller. 1988. "Ethanol Yield and Energy Potential of Stems from a Spectrum of Sorghum Biomass Types." *Biomass* 17(3):203-11.
- USDA, NRCS. 2007. The PLANTS Database. Accessed December 2, 2011. http://plants.usda.gov.

UF UNIVERSITY of FLORIDA
IFAS Extension

SS-AGR-333

Forage Sorghum (*Sorghum bicolor*): Overview and Management[1]

Yoana Newman, John Erickson, Wilfred Vermerris, and David Wright[2]

Sorghum (*Sorghum bicolor* [L.] Moench) is a warm-season (C_4 photosynthetic pathway), short-day annual grass. It grows best under relatively high temperatures and under sunny conditions. Sorghum as a crop originated as far back as 3,000 years ago. The selection in those early times was for grain more than for forage. However, selection for forage varieties has been occurring for the last hundred years. Forage sorghums are similar to grain types but are taller and have higher forage quality.

Sorghums in general can be classified into two types: forage types (mainly for forage or animal feed) and grain types (mainly for human consumption and not discussed in this publication). The forage sorghums are further grouped into four types: (a) hybrid forage sorghum, (b) sudangrass, (c) sorghum x sudan hybrids (also known as sudan hybrids), and (d) sweet sorghum. The latter is used mainly for molasses but more recently for biofuel production as well.

A. Hybrid Forage Sorghum

Hybrid forage sorghums (commonly referred to as forage sorghum) grow 8–10 ft tall and have relatively large stem diameters. These varieties have been selected for a one-time harvest or a single cut for silage production. This crop can produce yields similar to silage corn, but the forage quality is generally lower. Varieties that possess the *brown midrib* (BMR) trait have brown vascular tissue as a result of reduced lignin content, which improves digestibility. However, this trait may also increase the incidence of lodging in some varieties. Hybrid forage sorghums, like corn, may produce a forage crop containing up to 50% grain by weight, depending upon the hybrid and stage of maturity at harvest. Careful selection of BMR hybrids and timing of harvest are necessary to maximize total digestible nutrients (TDN). Highest crude protein and digestibility will usually be obtained by harvesting in the vegetative growth stage, whereas dry matter production will be increased with more mature plants. Harvesting in the hard-dough stage will result in a lower average TDN value but will maximize the amount of TDN harvested per acre.

B. Sudangrass

Sudangrass has finer stems, tillers more profusely, and is leafier than hybrid forage sorghums. They produce very few seed, and their rate of regrowth after cutting or grazing is generally superior to that of hybrid forage sorghums.

1. This document is SS-AGR-333, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date July 2010. Reviewed February 2013. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Yoana Newman, assistant professor, Agronomy Department; John Erickson, assistant professor, Agronomy Department; Wilfred Vermerris, associate professor, Agronomy Department; David Wright, professor, Agronomy Department, North Florida Research and Education Center, Quincy, FL; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611. This publication is a co-production with the University of Georgia Cooperative Extension–Forage and Biomass Agronomic Program (Extension Specialist Dennis Hancock) and is funded by the United Sorghum Checkoff Program.

For this reason, they are sometimes used for temporary rotational grazing. Furthermore, sudangrass accumulates less of the poisonous compound prussic acid (HCN) than forage sorghums.

C. Sorghum x Sudangrass Hybrids

Hybrids of forage sorghum and sudangrass have the highest yield potential of any of the summer annuals if adequate rainfall is received or irrigation is provided. Consequently, sorghum x sudan hybrids are commonly used for silage. When grazed, the sorghum x sudan hybrids should be rotationally stocked, allowing the forage to reach 24 inches before grazing. At this stage, sorghum x sudan hybrids will generally have TDN values in excess of 53%–60% and crude protein (CP) concentrations of 9%–15%. Varieties with the BMR trait are usually preferred for grazing. Research in Texas has indicated that BMR varieties may improve animal gains by as much as 5–8% relative to non-BMR varieties.

In the southeastern United States, sorghum x sudan hybrids are commonly used as a forage crop for stocker cattle and brood cows following a winter or spring crop. Sorghum x sudan forage crops are designed for multiple harvests and can be used as hay, silage, pasture, or green chop. Unfortunately, these hybrids dry very slowly, even if an impeller (flail) or roller-crimper conditioner is used during crop harvest. Consequently, hay production from these species is at greater risk of rain damage or being allowed to get too mature before hay harvesting is possible.

Because of the extended period when they can be planted, hybrid forage sorghum, sudangrass, and sorghum x sudan hybrids fit well in many crop rotation systems with winter-grown small grain or vegetable crops. Rotations utilize residual fertilizers from previous crops and are critical to pest management systems (e.g., root-knot nematode). Some vegetable producers sow sorghum cover crops to increase soil organic-matter content, retain soil nutrients, reduce weed populations, and reduce pest populations. Rotations following small grains or spring vegetable crops are common for grain production. The hybrid forage sorghums and sorghum x sudan hybrids work well in this rotation for dairy and beef cattle operations where high-quality grazing, green chop, or silage is needed.

1. Selection of Forage Sorghum (All Types)

a. Yield

Several hybrid forage-sorghum varieties have shown promising productivity in Florida and Georgia. In variety trials conducted by the University of Florida (UF) and the University of Georgia (UGA), the average yields during the most recent five years (2004–2009) were 6.3 dry tons/acre in Georgia and 6.1 dry tons/acre in Florida (Table 1). However, few differences between individual varieties were observed if favorable environmental conditions (rainfall amounts and seasonal distribution) and optimum soil fertility conditions were met.

Table 1. The average yield and range of hybrid forage-sorghum varieties in university variety trials in Florida and Georgia during 2004–2008.

	Average	Minimum	Maximum
		---------- (dry tons/acre) ----------	
Florida	6.1	2.6	11.7
Georgia	6.3	2.4	9.7

b. Maturity

Hybrid forage-sorghum yields differ based on the stage of maturity at which the crop is harvested (Table 2). Harvesting the crop at the vegetative stage ensures multiple harvests and results in the highest yields, such as producing yields exceeding 7 dry tons/acre. Lowest yields are obtained when the crop is harvested at the flowering stage. There are no differences in yields when the crop is harvested at either the soft- or hard-dough stage.

Table 2. Stage of maturity effects on dry matter yields of hybrid forage sorghums in Florida and Georgia.

Maturity stage	Minimum	Maximum	Average
		----------dry tons / acre----------	
Flowering	3.99	4.42	4.15
Soft dough	3.72	6.16	5.64
Hard dough	3.92	6.65	5.83
Vegetative	7.26	7.40	7.36

c. Stability of Yield

Stability of the hybrid forage sorghum was evaluated on the basis of yield consistency (yield by year and yield by season) and lodging rating (calculated as the total number of plants

that lodged as a function of the total number of plants per area, expressed in percentage) (Table 3). In general, depending on the hybrid, high-yielding forage sorghum hybrids can produce dry matter yields exceeding 11 dry tons/acre in good years when rainfall is evenly distributed throughout the growing season. In bad years, however, uneven rainfall distribution during the growing season results in low yields that generally range between 2.5 and 7.3 dry tons/acre.

The planting dates also have an effect on the dry matter yields of forage sorghum. The five-year study showed that when the crop is planted in the spring season, yields are generally high, and an average yield exceeding 8 dry tons/acre is reported. When the crop is planted in the summer months, yields tend to be low.

Hybrid forage sorghum has shown to be very stable in terms of lodging. Lodging was rated on several hybrids in trials in Florida during the 2009 growing season, and low lodging was observed among all the hybrids evaluated. The average number of the total plants that lodged, across all hybrids, was less than 1% of the total plant stand, suggesting that the plants are very stable.

Table 3. Stability of hybrid forage sorghum grown in Florida (2009).

Stability parameter	Minimum	Maximum	Average
Yields in good years (T/A)	3.52	11.67	6.25
Yields in bad years (T/A)	2.55	7.27	4.97
Yields for spring planting (T/A)	6.29	10.50	8.40
Yields for summer planting (T/A)	2.93	5.21	3.96
Lodging rating (%)	0.00	1.00	0.62

d. Seed Treatments

i. Seed Safeners

Recent advances in seed treatments for sorghum producers offer some advantages. Seed safeners, such as Concep III®, protect sorghum from chloroacetamide herbicides, such as metolachlor and dimethenamid. These herbicides can be highly valuable for preemergent grass and broadleaf weed control. However, if the seed safener is not present, use of these herbicides will result in severe sorghum injury or death.

ii. Insecticides

Seeds can also be treated with insecticides, such as Cruiser® and Gaucho®. These treatments eliminate the need for in-furrow applications of insecticides like Counter®. These seed treatments protect sorghum seed prior to emergence from below-ground pests like wireworm. In addition, they are systemic and protect your sorghum crop following emergence from above-ground pests like chinch bugs, greenbugs, red fire ants, and yellow sugarcane aphids. These treatments can enhance germination, plant stand and vigor, and improve yield stability. The treatments have to be performed according to instructions provided by the manufacturer. Treated seed is also available from seed companies.

iii. Fungicides

It is recommended to coat the seeds with a commercial fungicide prior to planting. The fungicide will reduce the risk of damping off, kernel smut, and downy mildew. Commercial products that can be considered are thiram (Thiram 50WP or Gustafson 42-S), fludioxonil (Maxim 4FS), pentachloronitrobenzene (RTU-PCNB), metalaxyl (Apron 50WP), and mefenoxam (Apron XL LS). All of these products will protect against damping off, whereas protection against additional pathogens depends on the specific compound. The treatment has to be performed according to instructions provided by the manufacturer.

2. Seedbed Preparation and Planning Practices

a. Understanding Targeted Yield Based on Your Situation

There are many sorghum varieties and large differences in sorghum production practices. This has led to some confusion and unrealistic expectations regarding yields. Sorghum is drought tolerant and can tolerate a wide range of soil conditions, but optimal yields still require the appropriate addition of nutrients and water. Therefore, it is critical to understand the differences in yield potential between the sorghum species/varieties, the yield potential of the site, and the production goals necessary for your situation.

b. Planting Date

There is a relatively wide range in planting dates for sorghum in the southeastern United States, mainly because sorghum germination is closely linked to soil temperature. For good stand development, it is important to ensure that the soil temperature at the 2" depth is at least 65°F. Cold

Risk Management Agency
Order No: D15PX00044

soils result in poor germination and emergence and lead to poor stand development. Planting too early is one of the most common causes of poor establishment.

Plantings may begin in March in South Florida and early to mid-April in Central and North Florida. New plantings can be made into summer until about 120 days prior to desired harvest (or first frost). Plantings made after mid-June may have lower yields and experience more disease and insect pressure. Plantings made after early July may produce very limited yields because of shortening daylengths. Early planted silage sorghums will produce a second (ratoon) crop in Florida, but yields are generally less than the original harvest.

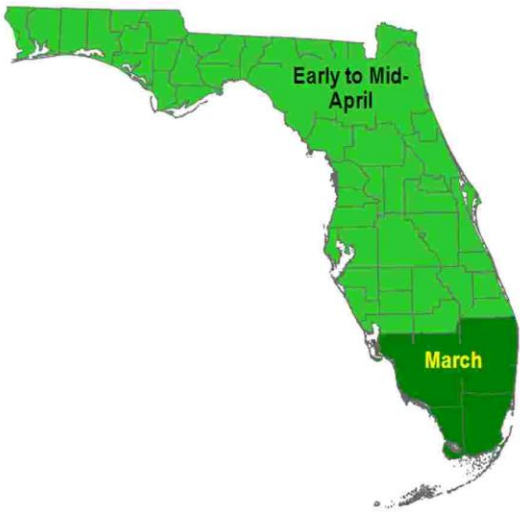

Figure 1. Map of Sorghum Optimal Beginning-Planting Dates in Florida.

c. Seeding Rate (Seed Number Per Acre vs. Pounds Per Acre)

Sudangrass and sorghum x sudan hybrids can be broadcast (B) or drilled. Hybrid forage sorghum (single cut) is usually planted in wide (20–36 inch) rows (R) to facilitate harvest and in-season field operations. The planter may need special plates or other modifications to handle sorghum seed. Recommended seeding rate for forage sorghum intended for silage use in Florida is 6–8 lb per acre (R) and 10–15 lb per acre (B). Recommended seeding rate for sorghum x sudan hybrids in Florida is 8–20 lb per acre (R) and 25–30 lb per acre (B). Excessive seeding can increase lodging (Table 4).

Table 4. Seeding rate for sorghums in Florida.

Species	(Row planting) Lbs. per acre	(Broadcast) Lbs. per acre
Hybrid Forage Sorghum	6–8	10–15
Sorghum x Sudan hybrids	8–20*	25–30
* If finer stems are desired, choose the higher rate		

To calculate seeds per acre:

$$\frac{lbs\ of\ seed}{acre} \times \frac{seeds}{1\ lb\ of\ seed} = \frac{number\ of\ seeds}{acre}$$

To calculate seeds per foot of row:

$$Row\ spacing\ (inches) \times 0.0833 \times \frac{\frac{Seeding\ Rate}{(lbs/acre)}}{43560} \times \frac{seeds}{1\ lb\ of\ seed} = \frac{seeds}{foot\ of\ row}$$

Table 5. Number of seeds per pound for different sorghum types.

	Seeds per lb
Hybrid Forage Sorghum	14,000–17,000
Sorghum x Sudangrass	15,000–21,000
Sudangrass	35,000–45,000

d. Plant Population/Row Width

Forage sorghum yields tend to increase with narrower rows. Final plant density should be adjusted to growth conditions in your region. In drier regions or regions with sandy soils that hold little water, planting density should be on the low end of the recommended range. Forage sorghums tend to be planted at relatively high densities to improve quality, but for BMR forage sorghums this is unnecessary. Recommended plant populations for BMR are 60,000–80,000 plants per acre (rows, irrigated), 70,000–100,000 plants per acre (drilled, irrigated), 40,000–80,000 plants per acre (rows, rain fed), and 50,000–80,000 plants per acre (drilled, rain fed).

e. Tillage Practices

Preparation of soil for planting generally includes plowing and harrowing. Plowing can be done in the fall or just before planting. In areas where soil erosion due to wind and water are a concern, conservation tillage may be appropriate. Sorghum also does well in no-till production systems. Studies have shown no consistent differences in

biomass yield when comparing no-till and conventional tillage practices. No-till has proven beneficial for yields in continuous sorghum rotations.

f. Planting Practices

Sorghum planting practices should match intended usage. Forage sorghum used in pastures can be planted by drill, a broadcast seeder, or in rows.

g. Seeding Depth

Recommended planting depth for hybrid forage sorghum is 1–1 1/2 inches for sandy soils and 3/4–1 1/4 inches in heavy soils. Seeds should be planted in moist soil and can be planted slightly deeper if necessary to reach moisture. However, shallower planting will result in quicker emergence and minimize disease problems that can be associated with delayed emergence.

Sudangrass and sorghum x sudan hybrids should be planted no deeper than 1 inch, specifically 1/4 to 1/2 in heavy soils and 1/2 to 3/4 in sandy soils.

3. Fertilizer Requirement

a. Timing of Application

For row plantings, preplant fertilization requirements can be broadcast and plowed down before planting. Alternatively, fertilizer can be applied at time of planting in continuous bands 2–3 inches to each side and 2–3 inches below the seed. For drill or broadcast plantings, the initial fertilization should be broadcast and disked into the soil ahead of planting, making sure not to place fertilizer in direct contact with the seed. Splitting the total fertilizer that is to be applied equally between an "at-planting" application and one or more additional applications during the growing season is highly recommended. This increases nutrient-use efficiency and reduces the risk of nutrient runoff, leaching, or gaseous loss. When the crop is produced for silage, the second application should be applied when the crop reaches a height of about 12 inches (and 24 inches if split three times). If the crop is grazed or cut for hay, split applications should be made after each grazing/harvest event.

b. Soil/Plant Testing for Nutrition

Adequate soil fertility is necessary for optimum yield, and soil testing is the means to evaluate soil fertility. Based on removal of the crop, 120 lb nitrogen (N; supplied as ammonium nitrate), 65 lb phosphorous (P; supplied as P_2O_5), and 120 lb potassium (K; supplied as K_2O) are recommended for 21-ton-per-acre yield potential. Adjust by 30-15-30 pounds for each 4-ton-per-acre change in yield goal.

As with all crops, an ample supply of available nutrients must be provided for optimal forage sorghum production. Maintaining optimum soil fertility is critically important for ensuring good establishment, persistence, pest tolerance, drought tolerance, forage quality, yields, and, most importantly, economic returns. If any nutrient is deficient, problems in one or all of these areas can occur. Thus, it is critical that a good soil fertility program be the basis of the management system for forage sorghums.

A soil test is the best tool for assessing soil fertility. Soil testing is a chemical analysis that reveals any soil fertility issues that may be limiting production. The key to soil testing is to ensure that the sample is representative of the area of interest. At the very least, each field should be sampled separately. Soil pH and some nutrients often will vary with soil type. Fields with substantially different soil types should be sampled separately within major soil types.

The soil sample analysis provides a guideline for the amount of lime or fertilizer needed to correct deficiencies or imbalances in soil pH or available nutrients. These amounts are determined by the specific needs of the crop being grown. Furthermore, soil test recommendations from land grant universities are based on decades of scientific studies. Thus, by regularly testing soil and following the recommendations, soil fertility can be maintained at levels that result in optimum productivity. In this section, the importance of several essential elements is briefly conveyed, and generalized recommendations are relayed. However, people should follow the soil test recommendations for their state or region, as they have been refined for those conditions.

c. Nitrogen

Rate of N application will vary depending on soil quality and production goals. For each green ton (600 dry lb) of sorghum forage produced, approximately 9 lb of N are removed. With good management, some varieties can produce 40 or more green tons (12 dry tons) per acre from a single crop.

In general, forage sorghum should receive 120–150 lb N per acre for a yield goal of 20–25 green tons (6–7.5 dry tons) per acre. Irrigated forage sorghums should receive up to 30% more N. When calculating N needed, consider residual soil N, soil organic matter, N content in irrigation water, and manure applications. Reduce the N rate by 20–40 lbs per acre following peanuts and soybeans and by 80–100 lbs per acre following alfalfa or a legume winter cover crop that is allowed to bloom.

Risk Management Agency
Order No: D15PX00044

General recommendations are that one-fourth to one-third of the total recommended N rate per acre should be applied just prior to or at planting. For silage production, topdress or sidedress the remaining N according to production goals when the crop reaches 18–24 inches (approximately 4–6 weeks after planting). If a second (ratoon) crop is attempted, fertilize at half the original rate when plants are 12–24 inches in height. For grazing purposes apply 30–50 lb N per acre after each grazing period or harvest, as needed.

d. Phosphorus

Sorghum response to P is typically only seen in soils with very low available P. Apply the entire soil-test-recommended P fertilizer in a preplant or planting application. In acid soils with low available P, banding P fertilizer near the furrow at planting may be warranted.

e. Potassium

Potassium availability for sorghum production is important, as K is an essential element for the plant and markedly improves disease and pest resistance. The addition of K is crucial, since removal rates by forage sorghum can be relatively high. The most common K formulation (muriate of potash or potassium chloride [KCl]) has also been shown to increase stalk strength and thus plays an important role in minimizing lodging. Recent evidence suggests that the chloride (Cl-) in KCl contributes to lodging resistance. If the forage sorghum production is intended for silage use, apply 30% of the soil-test-recommended K fertilizer as a preplant broadcast or as a starter application at planting. Topdress or sidedress the remaining 70% of the K fertilizer when the crop reaches 18–24 inches (approximately 4–6 weeks after planting). If a second (ratoon) crop is desired, fertilize at half the original rate. For sudangrass or sorghum x sudan hybrid crops that are intended for grazing, apply 50% of the soil-test-recommended K fertilizer as a preplant broadcast or starter application at planting. Apply the remaining 50% of the K fertilizer after the first grazing.

f. Sulfur

Fertilizer additions to forage sorghums should contain sufficient S to supply 10 lbs of S per acre. Since S is highly leachable, especially on deep sands, application of S with postplant nitrogen applications may improve efficiency.

g. pH

Sorghum is tolerant to a wide range of soil pH conditions (soil pH range from 5.5 to 8.5), but the optimum pH is 6 to 6.5. Soils in the southeastern United States are typically low in soil pH. Low soil pH can result in a poorly developed root system. Additionally, low soil pH alters the availability of many of the essential nutrients. Low soil pH reduces the nutrient-use efficiency of major nutrients like N, P, K, and S, and it frequently induces deficiencies (or toxicities) of minor nutrients like molybdenum (Mo), boron (B), zinc (Zn), and manganese (Mn). For these reasons, care should be taken to keep soil pH in the optimum range.

h. Minor/Trace Nutrients

Most minor nutrients should be available to the plant if soil pH values are in the optimum range. However, some soils may be deficient in one or more of the minor nutrients. The addition of minor nutrients should be applied according to soil test results.

Table 6. Nutrient recommendations.

Soil Test Rating		Potassium			
		Low K Coast: 0–60 lbs/A Pied: 0–100 lbs/A	**Medium K** Coast: 61–150 lbs/A Pied: 101–200 lbs/A	**High K** Coast: 151–250 lbs/A Pied: 201–350 lbs/A	**Very High K** Coast: 250+ lbs/A Pied: 350+ lbs/A
Phosphorus		Recommended Pounds N-P_2O_5-K_2O per Acre			
Low P	FL	150-100-100	150-100-50	150-100-0	150-100-0
	FL	150-100-125 (very low K)			
Medium P	FL	150-50-100	150-50-50	150-50-0	150-50-0
	FL	150-50-125 (very low K)			
High P	FL	150-0-100	150-0-50	150-0-0	150-0-0
	FL	150-0-125			
Very High P	FL	150-0-100	150-0-120	150-0-90	150-0-80
	FL	150-0-125	150-0-50	150-0-0	150-0-0

Risk Management Agency
Order No: D15PX00044

4. Water Management

a. Water-Use Requirements

Sorghum will respond to irrigation like most crops. However, due to its low market value, it is seldom irrigated. The increase in sorghum yield due to the added moisture may not pay for the irrigation costs. Forage sorghum is often grown after irrigated corn since irrigation is available from corn.

Sorghum is able to grow and survive in regions where rainfall is relatively low or where frequent dry periods occur. Still, growth and yield responses are closely related to available water. Limited data for water-use requirements are available in the southeastern United States. Water-use estimates reported elsewhere typically range from about 15–30 inches of water to produce a forage sorghum crop. Across this range of water use, a recent study using a BMR forage sorghum near Bushland, Texas, showed an increase in yield of approximately 0.83 tons per acre for each additional inch of water use, from about 10 tons per acre at 15 inches of water use to about 22 tons per acre at 30 inches of water use. Another recent study from the same location comparing sorghum and corn silage production reported lower seasonal crop water use by sorghum (19.3 compared to 26.4 inches). However, yields-per-unit-water-use were similar among sorghum and corn. These findings indicate that sorghum can be produced with less water, but yields will be commensurate with water use. So, in regions where water availability is low, irrigation is not available, or water use is restricted, sorghum offers an attractive alternative for forage production, but lower yields must be expected.

b. Timing of Moisture

Soil moisture is critical for germination. Water stress during booting, flowering, and grain fill can greatly reduce grain yields for grain sorghums. Other than germination, forage sorghums do not have the growth stages where water availability is critical, so they tend to use water more efficiently, and timing of moisture is less of a concern. As a result, forage sorghum planted in June in the southeastern United States will need little irrigation because rainfall is generally sufficient to produce a good crop. However, earlier plantings will run into moisture deficits, and irrigation will greatly increase yields.

5. Weed Control

Critical in sorghum production is the removal of competition during the initial stages of development. It should not be planted in fields that are infected with johnsongrass.

Broadleaf weeds can be effectively controlled through chemical applications.

For herbicide recommendations (pre- and postemergence), please refer to the IFAS Extension publication *Weed Management in Sorghum* (http://edis.ifas.ufl.edu/wg002).

6. Sorghum Diseases

Forage sorghums in Florida can be susceptible to several diseases. Potential diseases include anthracnose (major leaf disease), zonate leaf spot, rough spot, northern corn leaf blight, bacterial leaf stripe, rust, head mold, and ergot. Of these, ergot is the only disease that has caused significant damage on forage sorghum in the southeastern United States in the past few years. In fact, it is a rare occurrence when one or more of the diseases cause severe damage or economic loss in forage sorghum. Moreover, no fungicides are labeled for use on forage sorghum plantings. Disease management in forage sorghum plantings is largely mitigated by proper planting time and crop rotation.

Anthracnose (*Colleototrichum sublineolum*)

Symptoms

- Elliptical black lesions, >5 mm in diameter that develop circular, straw-colored centers with wide margins that may vary in color from reddish to blackish purple (Figure 2 A, B).
- On some cultivars, disease may defoliate the plant; in severe cases, plants will die before they reach maturity.
- Can also occur on stalks (where it is known as stalk or red rot), panicles (head rot), and the grain.
- Favorable disease conditions are frequent rains and warm nights.

Management

- Crop rotation
- Cultivar resistance (good resistance in forage sorghums). For disease rating from variety trials, check the following link: http://www.animal.ifas.ufl.edu/extension/CSFD/CSFD/2009Agenda.shtml.
- Suppression of grass weeds and volunteers around field
- Adjust planting date (mid-April to mid-May to avoid late-summer disease pressure in North Florida).

Risk Management Agency
Order No: D15PX00044

Figure 2 A, B. Anthracnose (*Colletotrichum sublineolum*)
Credits: Photograph by John Erickson, Agronomy, University of Florida.

Head Mold (*Fusarium, Curvularia, Colletotrichum, Alternaria,* and *Bipolaris* spp.)

Symptoms

- Florida's warm, wet summer weather is conducive to head mold.
- Infection by some *Fusarium* spp. can produce toxins that are poisonous to livestock.
- Abnormal colorations and moldy growths on the head (Figure 3).
- *Fusarium* spp. cause white-pink colors on the outside of flowers and seed.

Management

- Can be severe in some plantings, especially in varieties with tight heads or panicles or some non-bird-resistant types of sorghum.
- Red seed coats provide some resistance to this disease complex.

Figure 3. Head Mold (*Fusarium, Curvularia, Colletotrichum, Alternaria,* and *Bipolaris* spp.)
Credits: Photograph by John Erickson, Agronomy, University of Florida.

- Plant at a time of year when flowering initiates during drier months, reduce insects such as sorghum midge, use resistant varieties.

Ergot (*Claviceps africana*)

Symptoms

- Intitial symptom is appearance of sphacelia, which is a white swelling of the seed (Figure 4).
- Sphacelia produce honey dew and spores.
- Black sclerotia develop in place of the seed and give an overall black, sooty appearance to the seedhead.

Figure 4. Ergot (*Claviceps africana*)
Credits: Photograph by Curtis Rainbolt, Agronomy, University of Florida.

Management

- Especially problematic on later plantings or plantings that mature later.
- Male, sterile forage sorghum is also at heightened risk for ergot.
- An active infection cannot be cured. Avoid late planting and utilize cultivar resistance.
- Early applied fungicides can be effective but may be cost prohibitive.

Bacterial Leaf Stripe (*Pseudomonas andropogonis*)

Symptoms

- Reddish-purple to tan-brown, somewhat-linear spots (Figure 5).
- Lesions tend to be interveinal and may attain lengths of 8" with lesion color uniform throughout.
- Favors warm, wet weather conditions.

Management

- Not a major problem in Florida.
- Most forage sorghum varieties have tolerance and/or resistance to this bacterial disease.
- Crop rotation.
- Resistant varieties.
- Plowing down old crop debris.
- Avoid field operations when the field is wet.

Figure 5. Bacterial Leaf Stripe (*Pseudomonas andropogonis*)
Credits: Photo courtesy of the University of Georgia College of Agriculture and Environmental Sciences. Available at: http://plantpath.caes.uga.edu/extension/plants/fieldcrops/Bacterialleafstripe.html.

Northern Corn Leaf Blight (*Exserohilum turcicum*); pathogen also known as *Bipolaris* spp. or *Helminthosporium* spp.

Symptoms

- Lesions are cigar-shaped, tan to brown in the center (Figure 6).
- Lesions are sometimes surrounded by a dark, brown-reddish purple border or narrow band of water soaking.

Management

- Rarely seen disease on forage sorghum in Florida.
- Resistant varieties.
- Crop rotation with nongrass crops.
- Bury old sorghum crop debris.
- Destroy johnsongrass and volunteers of susceptible crops in the vicnity.

Figure 6. Northern Corn Leaf Blight (*Exserohilum turcicum*); pathogen also known as *Bipolaris* spp. or *Helminthosporium* spp.
Credits: Photo courtesy of Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, Bugwood.org. Available at: http://www.ipmimages.org/browse/subimages.cfm?area=72&sub=16546.

Rust (*Puccinia* spp.)

Symptoms

- Pathogen produces elongated, raised pustules in leaves and in outer tissue of the peduncle (head stem).
- Pustules in leaves are <1/8" long and often surrounded by a reddish-brown to tan halo (Figure 7).
- Pustules in peduncle may be longer and linear or within oval, red-to-brown lesions. Within raised pustule, a red-to-orange-brown mass of spores will be exposed if the pustule covering has ruptured.
- Spores are easily dispersed by wind. Pathogen also produces telial lesions, which are dark brown to black in color.
- Favors cool, wet conditions.

Management

- Has not been a major problem in Florida.
- Resistant varieties.
- Management of rust-harboring weed species, such as red sorrel.

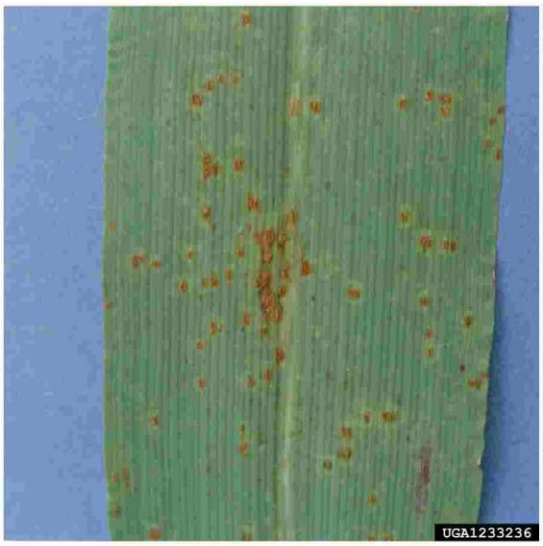

Figure 7. Rust (*Puccinia* spp.)
Credits: Photo courtesy of Clemson University, USDA Cooperative Extension Slide Series, Bugwood.org. Available at: http://plantpath.caes.uga.edu/extension/Fungi/puccinia.html.

Zonate Leaf Spot (*Gloeocercospora sorghi*)

Symptoms

- Early lesions can be similar to *Anthracnose*.
- Larger lesions have distinctive, circular alternating bands of white or tan with outer bands of reds, purples, or browns (Figure 8).
- Disease favors frequent rains and warm nights.

Figure 8. Zonate Leaf Spot (*Gloeocercospora sorghi*)
Credits: Photo courtesy of the University of Georgia College of Agriculture and Environmental Sciences. Available at: http://plantpath.caes.uga.edu/extension/plants/fieldcrops/zonateleafspot.html.

Management

- Historically, has not been a major problem in Florida.
- Management includes crop rotation.
- Use resistant varieties.
- Bury old crop debris by plowing.
- Avoid field tasks when leaves are wet.

Further information on disease symptoms and management:

- The University of Florida has online information on plant pathology for sorghum crops: http://plantpath.ifas.ufl.edu/takextpub/FactSheets/circ1073.pdf.
- The University of Georgia has a plant pathology website that is a disease library and includes information on sorghums about 2/3 of the way down the page: http://plantpath.caes.uga.edu/extension/DiseaseLibrary.html.

7. Sorghum Insects and Nematodes

a. Insects

A number of insect pests cause economic damage to sorghum plantings in the southeastern United States. Many of the insects that attack corn also can attack sorghum. Three insect pests that are commonly found on sorghum in the southeastern United States are sorghum midge (*Contarinia sorghicola* [Coquillett]), greenbug (*Schizaphis graminum* [Rondani]), and chinch bug (*Blissus insularis*). A description and picture of these three insects can be found below.

Sorghum Midge (*Contarinia sorghicola* [Coquillett])

Description and Damage

Sorghum midge is the most damaging of the pests. It is a small (1.3 mm), orange-red fly with a yellow head, brown antennae and legs, and gray wings (Figure 9). The female fly lays her eggs in the panicle of the sorghum plant, between the glumes of open (flowering) spikelets. Because of its short generation time (2 weeks), high infestation rates can occur. Infestation with sorghum midge will result in reduced seed production.

Management

Damage due to sorghum midge can be reduced by planting early and by uniform panicle emergence, which allows limited opportunity for later generations to thrive on more slowly maturing panicles.

Figure 9. Sorghum Midge (*Contarinia sorghicola* [Coquillett])
Credits: Photograph by Alton N. Sparks, Jr., University of Georgia, Bugwood.org. Available at: http://www.ipmimages.org/browse/detail.cfm?imgnum=1327122.

Midge-resistant hybrids and application of insecticides can further reduce damage.

Greenbug (*Schizaphis graminum* [Rondani])

Description and Damage

Greenbugs are aphids and have a light green or dark green appearance (Figure 10). Adults are approximately 1.6 mm long.

They live on the underside of the leaves and produce a sticky residue known as honeydew.

Damage to sorghum results when the aphids suck juice out of the plant and inject toxins. The toxins will damage the leaves and weaken the plant, resulting in reduced stand, lodging, and yield losses. Greenbug populations generally decline towards the end of the season because of the parasitic braconid wasp (*Lysiphlebus testaceipes* [Cresson]).

Figure 10. Greenbug (*Schizaphis graminum* [Rondani])
Credits: Photograph by Guy Bishop, University of Idaho/Susan Halbert, Florida Department of Agriculture and Consumer Services.

Management

Damage due to greenbugs can be controlled by organophosphorus insecticides, which have to be applied at low rates to avoid damaging other insects.

Chinch Bug (*Blissus insularius*)

Description and Damage

Chinch bugs affect mostly seedlings. Adult chinch bugs are 4.2 mm in length and are dark in color with white forewings (Figure 11 B). The larvae are red to black with a light stripe across the abdomen (Figure 11 A). The eggs are laid

behind the sheath of the lower leaves. With a 30–40-day life cycle, it is common to have 2–3 generations of chinch bugs per growing season.

Both young and adult chinch bugs suck juice from the stem and roots, resulting in weakened and stunted plants and yield losses.

Figure 11 A, B. Chinch Bug (*Blissus insularis*); A. Nymph and B. Adult
Credits: Photographs by Lyle Buss, University of Florida.

Management

Chinch bug damage can be limited by planting sorghum early and at high density. Insecticides can be used to control chinch bugs during the early stages of plant development.

Additional Information:

Sorghum midge: http://sorghumipm.tamu.edu/pests/panicles/smidge.htm.

Greenbug: http://sorghumipm.tamu.edu/pests/leaves/grnbug.htm.

Chinch bug: http://sorghumipm.tamu.edu/pests/seedling/cbug.htm.

http://www.lsuagcenter.com/NR/rdonlyres/322D2121-2EE3-496B-9256-1402339916D7/10285/pub2496cinch-bugs4.pdf.

8. Nematodes

Many plant-parasitic nematodes that parasitize other crops also attack sorghum and sorghum x sudan hybrids and can limit yields when sorghum crops are planted back to back. However, out of the many plant-parasitic nematodes, *Prat ylenchus* spp. and *Belonolaimus* spp. seem to be responsible for yield reduction in most hybrids. These nematodes have been found to build up to levels that can destroy sorghum root systems and cause a crop failure on well-drained sandy soils. This can occur in just two seasons where spring grain sorghum was followed by rye for grazing in the winter, then followed by summer silage sorghum the second year. Proper crop rotation is critical to maintain optimum sorghum productivity.

Sorghums should be rotated with broad-leaved crops between growing seasons. Examples of broad-leaved crops might include southern peas, cotton, soybean, potatoes, sweet potatoes, cucurbits, and solanaceous crops.

Pratylenchus (*Pratylenchus* sp.)

Description and Damage

- Yellowing and stunting of top growth
- Lesions on roots
- Loss of primary roots and severe pruning of roots

Management

Buildup to damaging levels of this pest can be delayed by using varieties with some resistance to these nematodes. For pest-resistant varieties' ratings, please check the sorghum variety trials links on the following website: http://animal.ifas.ufl.edu/extension/CSFD/CSFD/2009Agenda.shtml.

The use of nematicides also helps in delaying the buildup of nematodes.

Risk Management Agency
Order No: D15PX00044

9. Preharvest Desiccants for Sorghum

Preharvest desiccants are commonly used in grain sorghum. For forage sorghums, no preharvest desiccants are labeled, and those that are commonly used in grain sorghum have harvest interval restrictions that make them impractical for forage use (i.e., the feeding restriction after application is too long for these products to be feasible).

10. Harvesting Forage Sorghum

The time of harvest can be critical to sorghum yields. Silage sorghums should be harvested at soft-dough stage for maximum dry matter yield and forage quality. Green-chop sorghums should be harvested preboot for repeated cuttings. Ratoon crops of either silage or forage sorghums should leave at least two intact nodes (counting from the soil surface upward, usually over 6 inches) for regrowth and need an application of nitrogen fertilizer. Grain should dry sufficiently in the field, but if left longer than necessary, bird predation, ergot, and other diseases in the seedhead can significantly reduce yield. Syrup sorghums should be harvested at peak sugar content (highest °Brix, measured from juice expressed at the 4th node from the soil level).

11. Drying and Storage of Forage Sorghum

If harvesting sudangrass or sorghum x sudan hybrids, it is best to use a roller-crimper mower-conditioner. Research in Georgia has indicated that it takes sudangrass or sorghum x sudan hybrids at least 1–2 days longer to dry to hay-making moistures than the perennial grasses conventionally used as hay crops in the southeastern United States. Failure to use a roller-crimper mower-conditioner may add 3–4 additional days to this drying time.

12. Marketing Strategies for the Southeastern United States

Sorghum silage hybrids can produce high fresh weight yields of silage. In northeast Florida on a wet flatwoods soil site, highest crude protein, total digestible nutrients and 13 fresh weight yields were obtained when the silage hybrids were harvested at the soft-dough stage of maturity with an intermediate nitrogen rate. Custom-chopping silage for local dairies and feed lots is an option. Large enough equipment is now available to cut, allow wilting to 50%–60% moisture, roll, and bag for ensilaging in 1,000-pound plastic-wrapped units. The wrapped units can be stored and transported when needed by livestock producers.

The production of sorghum x sudangrass hybrids and sudangrass for grazing is directly tied to beef cattle and dairy production systems. These grasses are efficient users of nutrients, making them adapted to capturing nutrients from lagoon spray fields in the form of forage, which can again be recycled through the ruminant animal. Pastures of these grasses could be used to raise replacement beef heifers and dairy cattle. Backgrounding beef calves on a contract basis might be an option. The movement to buy locally raised beef and pasture-raised beef could be exploited, although this is a small, currently emerging market.

Acknowledgements

The authors would like to thank the United Sorghum Checkoff Program for facilitating the production of this publication.

Selected References

Carmi, A., Y. Aharoni, M. Edelstein, N. Umiel, A. Hagiladi, E. Yosef, M. Nikbachat, A. Zenon, J. Miron. 2006. Effects of irrigation and plant density on yield, composition and in vitro digestibility of a new forage sorghum variety, Tal, at two maturity stages. *Animal Feed Science and Technology* 131:121-133.

Dahlberg, J. 2000. Classification and characterization of sorghum. pp. 99-130. In C. W. Smith and R. A. Frederiksen (ed.) *Sorghum origin, history, and production*. John Wiley Publishers, New York, NY.

Ferrell, J. A., G. E. MacDonald, and B. J. Brecke. 2007. *Weed management in sorghum – 2009*. EDIS Document SS-AGR-06, Florida Cooperative Extension Service, University of Florida. Available at: http://edis.ifas.ufl.edu/wg002.

Fribourg, H., and J. C. Walter. 2002. Summer annual grasses (grain) and forage sorghums, sudangrass, and millets. In: Forage Information System.

Hancock, D. W. 2009. Sorghums. Univ. of Georgia Crop and Soil Sci. Dept. Fact Sheet CSS-F025. Available at: http://www.caes.uga.edu/commodities/fieldcrops/forages/species/documents/Sorghums.pdf

Miron, J., E. Zuckerman, G. Adin, M. Nikbachat, E. Yosef, A. Zenou, Z. G. Weinberg, R. Solomon, and D. Ben-Ghedalia. 2007. Field yield, ensiling properties and digestibility by sheep of silages from two forage sorghum varieties. *Animal Feed Science and Technology* 136:203-215.

Newman, Y. C. 2009. Sorghum. In Forages of Florida website. http://agronomy.ifas.ufl.edu/ForagesofFlorida/detail.php?sp=Sorghum&type=G.

Stromberg, E., Phipps, P. M., Grybauskas, A. P., and R. P. Mulrooney. 2009. Diseases and Nematodes: Corn and Sorghum. Field Crops 2009.

Unger, P. W. 1988. Grain and forage sorghum production with no-tillage on dryland. *Agronomy Journal* 80:193-197.