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Available Feedstock for Agricultural Based Fuel Pellet Production in South West and South Central Missouri

FINAL REPORT

January 23, 2012

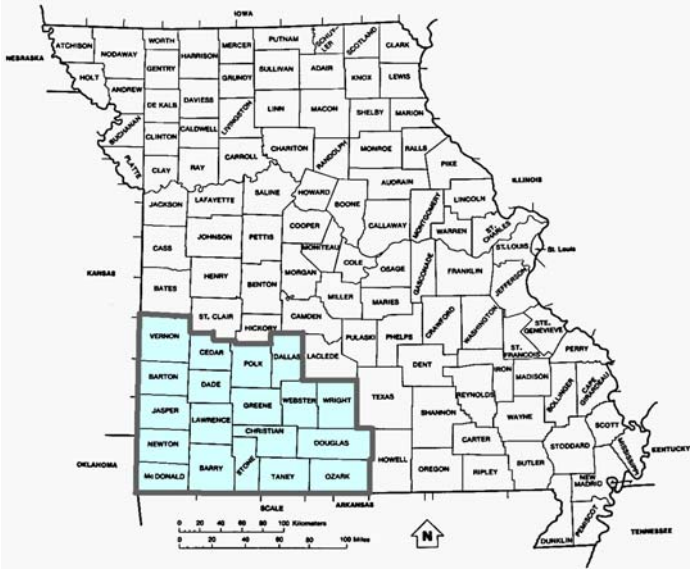

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TABLE OF CONTENTS

SUMMARY OF PROJECT 4

Analysis Of Availability Of Crop Residues In Southeast/Central Missouri With Characteristics For Use In Agricultural Based Fuel Pellet Production 12

Pictures of Samples 16

Corn Samples (typical sample) 16

Fescue Samples (typical sample) 16

Milo Samples (typical sample) 17

Native Grass Samples (typical samples) 17

Sorghum Samples (typical samples) 18

Soybean Samples (typical samples) 18

Wheat Samples (typical samples) 19

CORN DATA 21

SORGHUM DATA 30

WHEAT DATA 39

SOYBEAN DATA 48

FESCUE DATA 57

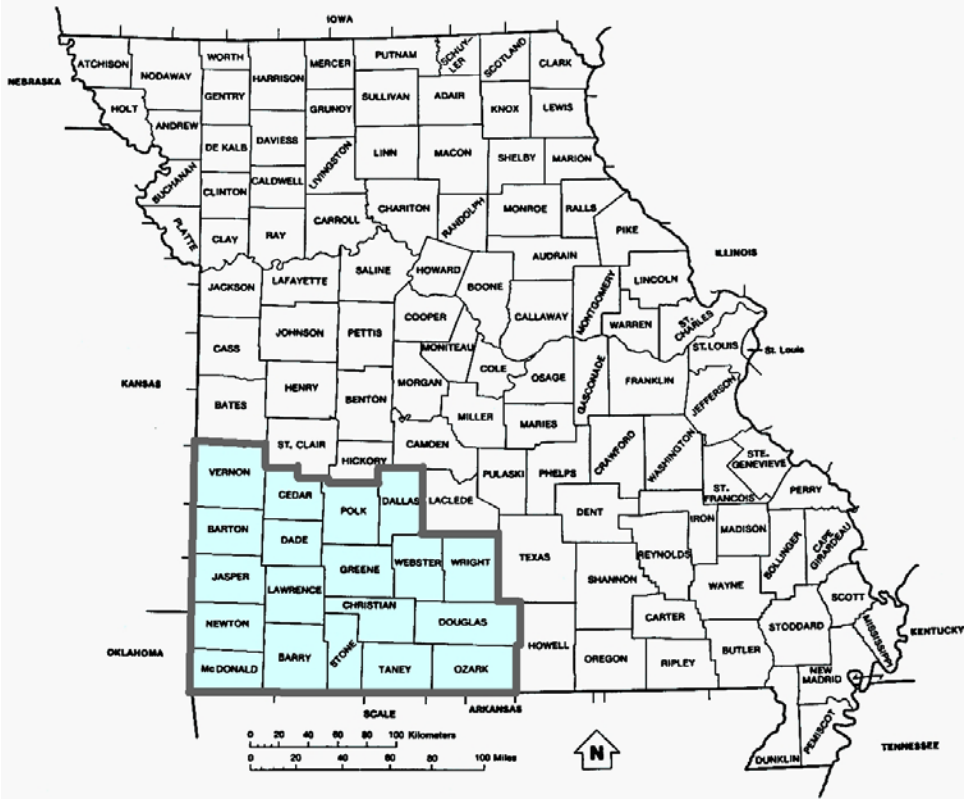
PERSONNEL: 62

HISTORY AND QUALIFICATIONS 63

REFERENCES 65

SUMMARY OF PROJECT

This project was to conduct research on available information from various sources, including field surveys, current available data, and other sources, on available agricultural based biomass sources suitable for fuel pellet production. The Research identified location, type, characteristics, availability, energy content, and other available information for fuel pellet production usage. The following Missouri counties were part of this study: Vernon, Barton, Jasper, Newton, McDonald, Cedar, Dade, Lawrence, Barry, Polk, Greene, Christian, Stone, Taney, Dallas, Webster, Douglas, Ozark, and Wright.



These counties were selected as being applicable to Biochoice Energy Group's intention on producing fuel pellets from agricultural crop residues. This study is also applicable to other agricultural based energy projects, such as the Show Me Energy facility which was recently selected for the USDA BCAP program.

Potential agricultural biomass products that were addressed in this study included crop residues from: corn, fescue, milo, soybeans, wheat, sorghum, and other crop residues.

The results of this study provide information for existing and prospective fuel pellet producers on the availability and quality of existing agricultural based biomass sources.

This project was accomplished with the assistance of BioChoice Energy Group and Business Consulting Services.

Characteristics used for Available Biomass:

In conjunction with Bio Choice Energy Group, a partner in this study and a potential user of the crop residues, the following information was deemed necessary or useful for assessing the crop residues biomass availability for use in fuel pellet production.

Crop Residue (Corn, Sorghum, Winter Wheat, Soybeans, Fescue Seed, Other)
Location (County)
Harvested Acres per yr.
Production (Bu)/yr.
Yield (Bu/Acre)
Tons of residue per acre
Total dry tons of residue per yr.
Total dry tons of harvestable residue per year (after leaving appropriate crop residue for soil use)
Available production Btu (million Btu)

Specific Crop Residue desired characteristics for fuel pellet usage (BioChoice Energy Group Feasibility Study)[1]

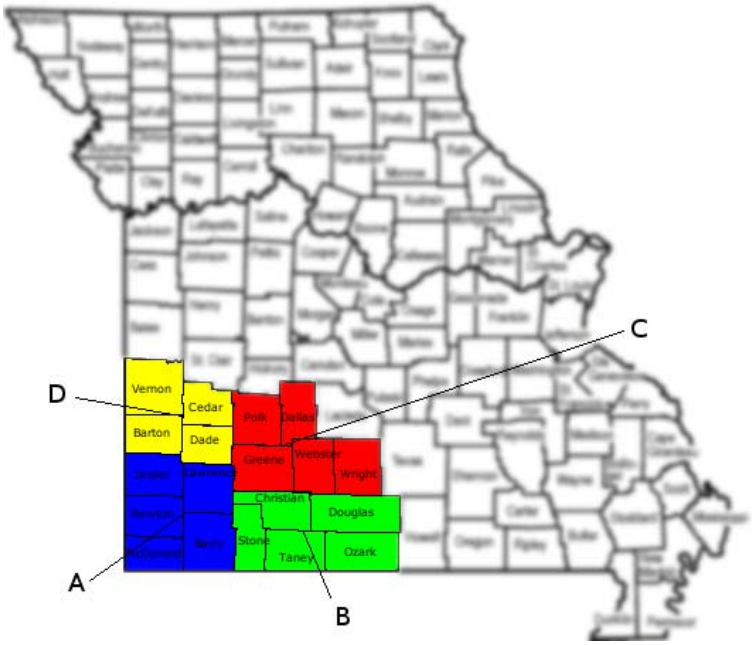
- Moisture 14-18%
- Ash 9%
- Btu value 6,478 – 6,794

By categorizing the crop residue by the type of residues (e.g., corn, sorghum, et al), the estimates and calculations for the available biomass residue and associated heat values will be more accurate.

The latest available data was utilized. Limited survey data for 2010 was available in time for this study. The majority of data utilized from 2005-2009 (using the latest available for the above characteristics)[2 3 4 5.]

Data and analysis of samples that were taken in this study included (but not limited to): Crop Residue, Location, Moisture, Crude Protein, Acid Detergent Factor (ADF), Neutral Detergent Fiber (NDF), Ash, Digestible NDF, Total Digestible Nutrient (TDN), Net Energy, Relative Feed Value, Calcium, Potassium, Phosphorus, Magnesium, Iron, Copper, Sulfur, & Zinc.

The subject region was subdivided into 4 regions for assistance in tracking and also as an aid for the analysis of transportation costs to potential customers of the crop residues (page 11).



Sampling rates utilized to ensure reliable and complete data, as well as any other pertinent information

Sunesis utilized sampling process to validate and, as necessary, to update the data. The information from the survey data was used as a check against the database, e.g., acreages, crops, energy values, et al.

Sunesis utilized BioChoice, BCS, and Sunesis staff in the crop residue sampling phase of this project.

Sunesis and its partners had solicited farmers in the region for participation in the sampling and survey data. The response was less than was expected.

BioChoice and BCS had numerous contacts and customers/suppliers in the region, and continued to solicit crop residue samples until the fields were being readied for planting the next season's crops. The samples were collected, along with survey data (region, county, farm location, crops, acreage, and contact information).

Sunesis engaged a laboratory (Olsen's Agricultural Laboratory) to conduct the sample analyses. The original proposal was to conduct 5 samples. During the conduct of the study, Sunesis and its partners attempted to obtain 40 samples, but only 26 were able to be obtained and analyzed, due to the reluctance of farmers in the region to participate in sample analyses and feed assessments. Sunesis and its partners continually attempted to obtain the data from the regional farmers with limited success.

At the beginning of March (and in some cases earlier), farming activities commenced on the farms to prepare for the spring planting. This activity precluded the field assessment activities of having any merit after that time.

The purpose of this field assessment was to compare the results with the USDA field reports of 2005. In our research, we were able to obtain USDA field report data for 2007 and limited 2010 data, which provided the needed comparison data for the conduct of our study. The field assessments were used with the sample analyses results for characterization analysis.

The average heating value (BTU/lb) of Corn, Sorghum, Wheat, Soybean, & Fescue residues used in the report utilized the data from Performing Energy Calculations-English Units, Penn State College of Agricultural Sciences, Dennis Buffington, 06/2008 and the Final Report - An Assessment of Biomass Feedstock Availability in Missouri Rodney J. Fink & Ross L. Fink[9]. The values used are:

Corn	7060 BTU/lb
Sorghum	7500 BTU/lb
Winter Wheat	6840 BTU/lb
Soybeans	6660 BTU/lb
Fescue	8000 BTU/lb

In regard to the Sample Analyses values for TDN, Net Energy Lactation, Net Energy Maintenance, Net Energy Gain, contrary to our initial expectations, we could not find any definite correlation between the Sample Analysis Energy values and the crop residue biomass heat values. The Total Digestible Nutrients, Net Energy Lactation, Net Energy Maintenance, Net Energy Gain are measurement relative to the digestibility of the forage for animal feedstock. They are related to the digestible dry matter for use by the animal being feed the residues. Despite our initial assumptions, there is no conversion method to convert these to the heating value of the crop residues.

This conclusion about TDN, etc., is confirmed by the following references:
-Equine Clinical Nutrition-Feeding and Care, Lon D. Lewis, 1995
-Energy – AG240, Beth LaShell, 2/10/2003
-Total Digestible Nutrients as a Measure of Feed Energy, L.A. Maynard, Cornell University, 5/14/1953
-Effect of Energy as Supplied by Hay or High-Concentration Rations and Frequency of Feeding on Performance of Ewes, R.M. Jordan, University of Minnesota, J AMIN SCI 1966

Task 5– Sample Analyses

The following tables are the tabulated results of the agricultural laboratory testing and analysis of the samples.

Sample Analyses of Crop Residues Collected in This Study

AR - as received OD - Oven Dried

Date	Crop	Sample ID:	Region	County	Moisture, %		Dry Matter, %		Crude Protein,%		Acid Detergent Fiber, %		Neutral Detergent Fiber, % (NDF w/Na2SO3)		Ash, %	
					AR	OD	AR	OD	AR	OD	AR	OD	AR	OD	AR	OD
12/09/10	Corn	A211	A	Newton	12.4	0.0	87.6	100.0	7.3	8.3	42.9	49.0	64.4	73.5	2.1	2.4
12/09/10	Fescue	A271	A	Newton	30.2	0.0	69.8	100.0	11.0	15.8	10.6	15.1	18.1	25.9	4.0	5.7
12/09/10	Milo	A291	A	Newton	36.6	0.0	63.4	100.0	8.6	13.6	22.9	36.1	39.1	61.7	4.3	6.7
12/09/10	Corn	A411	A	Lawrence	29.9	0.0	70.1	100.0	4.5	6.4	35.1	50.0	57.5	82.1	1.9	2.8
12/09/10	Soybeans	A441	A	Lawrence	21.9	0.0	78.1	100.0	9.3	12.0	39.0	50.0	51.0	65.3	3.3	4.3
12/09/10	Native Grass	A481	A	Lawrence	13.6	0.0	86.4	100.0	7.8	9.0	33.7	39.0	56.6	65.5	4.2	4.9
12/09/10	Corn	A511	A	Barry	19.5	0.0	80.5	100.0	4.5	5.6	40.5	50.3	62.9	78.2	2.5	3.1
12/09/10	Soybeans	A541	A	Barry	16.2	0.0	83.8	100.0	9.5	11.3	41.9	50.0	55.3	66.0	3.3	3.9
12/09/10	Fescue	A571	A	Barry	23.0	0.0	77.0	100.0	7.9	10.2	33.5	43.5	55.8	72.5	6.2	8.1
12/09/10	Corn	D311	D	Barton	20.2	0.0	79.8	100.0	4.8	6.1	32.1	40.3	55.8	69.9	2.6	3.3
12/09/10	Wheat	D331	D	Barton	12.2	0.0	87.8	100.0	2.8	3.2	48.4	55.1	69.5	79.1	3.8	4.3
12/09/10	Soybeans	D341	D	Barton	12.6	0.0	87.4	100.0	3.8	4.3	54.7	62.6	67.7	77.4	2.5	2.9
02/21/11	Sorghum	A121	A	Jasper	14.6	0.0	85.4	100.0	6.9	8.1	37.0	43.4	61.9	72.5	3.0	3.6
02/21/11	Native Grass	A181	A	Jasper	26.5	0.0	73.5	100.0	5.7	7.8	38.2	52.0	46.8	63.6	3.4	4.6
02/21/11	Milo	A191	A	Jasper	34.0	0.0	66.0	100.0	10.2	15.4	27.2	41.2	40.6	61.5	4.3	6.6
02/21/11	Sorghum	A321	A	McDonald	18.0	0.0	82.0	100.0	7.3	8.9	31.1	37.9	54.7	66.7	3.2	3.9
02/21/11	Sorghum	C121	C	Polk	16.0	0.0	84.0	100.0	7.5	9.0	34.9	41.6	56.5	67.3	4.1	4.8
02/21/11	Corn	C211	C	Dallas	12.3	0.0	87.7	100.0	6.2	7.1	42.9	48.9	67.7	77.2	1.9	2.2
02/21/11	Fescue	C371	C	Green	22.7	0.0	77.3	100.0	12.0	15.6	13.2	17.1	23.9	30.9	4.9	6.4
02/21/11	Fescue	C571	C	Wright	9.8	0.0	90.2	100.0	5.8	6.4	49.7	55.1	70.0	77.7	4.1	4.5
02/21/11	Corn	D111	D	Vernon	12.0	0.0	88.0	100.0	5.7	6.5	44.6	50.7	75.0	85.2	1.6	1.8
02/21/11	Corn	D112	D	Vernon	13.3	0.0	86.7	100.0	9.9	11.4	37.8	43.6	62.1	71.6	2.8	3.2
02/21/11	Fescue	D271	D	Cedar	13.4	0.0	86.6	100.0	8.2	9.4	45.5	52.5	63.4	73.2	3.9	4.5
02/21/11	Milo	D291	D	Cedar	16.0	0.0	84.0	100.0	10.8	12.9	35.1	41.8	54.6	65.0	5.2	6.2
02/21/11	Sorghum	D421	D	Dade	21.6	0.0	78.4	100.0	5.8	7.4	30.6	39.0	53.0	67.6	2.7	3.4
02/21/11	Fescue	D471	D	Dade	18.5	0.0	81.5	100.0	12.7	15.6	14.8	18.1	26.0	32.0	5.7	7.0

Sample Analyses of Crop Residues Collected in This Study

AR - as received OD - Oven Dried

Date	Crop	Sample ID:	Region	County	Total Digestible Nutrients (TDN), %		Calculated Net Energy Lactation, Mcal/lb		Calculated Net Energy Maintenance, Mcal/lb		Calculated Net Energy Gain, Mcal/lb		Relative Feed Value (Wet Chemistry)		Calcium, %	
					AR	OD	AR	OD	AR	OD	AR	OD	AR	OD	AR	OD
12/09/10	Corn	A211	A	Newton	41.9	47.8	0.42	0.48	0.35	0.40	0.14	0.16		64.0	0.27	0.31
12/09/10	Fescue	A271	A	Newton	54.0	77.3	0.56	0.81	0.59	0.85	0.39	0.56		277.0	0.23	0.33
12/09/10	Milo	A291	A	Newton	39.4	62.1	0.40	0.64	0.40	0.63	0.23	0.36		92.0	0.44	0.69
12/09/10	Corn	A411	A	Lawrence	32.7	46.6	0.33	0.46	0.27	0.39	0.10	0.14		57.0	0.12	0.17
12/09/10	Soybeans	A441	A	Lawrence	35.3	45.3	0.35	0.45	0.28	0.36	0.09	0.12		71.0	0.35	0.45
12/09/10	Native Grass	A481	A	Lawrence	50.9	58.9	0.52	0.60	0.50	0.58	0.28	0.32		83.0	0.49	0.57
12/09/10	Corn	A511	A	Barry	37.3	46.3	0.37	0.46	0.31	0.38	0.11	0.14		59.0	0.18	0.22
12/09/10	Soybeans	A541	A	Barry	37.9	45.2	0.38	0.45	0.30	0.36	0.10	0.12		70.0	0.56	0.67
12/09/10	Fescue	A571	A	Barry	41.5	53.9	0.42	0.55	0.39	0.50	0.19	0.25		71.0	0.23	0.30
12/09/10	Corn	D311	D	Barton	45.9	57.5	0.47	0.59	0.44	0.56	0.24	0.30		77.0	0.22	0.27
12/09/10	Wheat	D331	D	Barton	36.0	41.0	0.35	0.40	0.26	0.29	0.05	0.05		54.0	0.26	0.30
12/09/10	Soybeans	D341	D	Barton	27.8	31.8	0.26	0.30	0.11	0.13	N/A	N/A		48.0	0.66	0.75
02/21/11	Sorghum	A121	A	Jasper	46.2	54.1	0.47	0.55	0.43	0.50	0.21	0.25		71.0	0.18	0.22
02/21/11	Native Grass	A181	A	Jasper	32.6	44.4	0.32	0.44	0.26	0.35	0.08	0.11		71.0	0.62	0.84
02/21/11	Milo	A191	A	Jasper	37.3	56.5	0.38	0.57	0.36	0.54	0.19	0.29		86.0	0.62	0.93
02/21/11	Sorghum	A321	A	McDonald	49.3	60.1	0.50	0.62	0.49	0.60	0.28	0.34		83.0	0.17	0.21
02/21/11	Sorghum	C121	C	Polk	47.1	56.1	0.48	0.57	0.45	0.54	0.24	0.28		78.0	0.28	0.33
02/21/11	Corn	C211	C	Dallas	42.0	47.9	0.42	0.48	0.36	0.41	0.14	0.16		61.0	0.17	0.19
02/21/11	Fescue	C371	C	Green	64.4	83.3	0.68	0.87	0.72	0.93	0.49	0.63		228.0	0.32	0.41
02/21/11	Fescue	C571	C	Wright	36.9	40.9	0.36	0.40	0.26	0.29	0.05	0.05		55.0	0.23	0.25
02/21/11	Corn	D111	D	Vernon	40.4	45.9	0.40	0.46	0.33	0.37	0.11	0.13		54.0	0.21	0.23
02/21/11	Corn	D112	D	Vernon	46.7	53.8	0.47	0.54	0.43	0.50	0.21	0.25		71.0	0.29	0.34
02/21/11	Fescue	D271	D	Cedar	37.9	43.8	0.38	0.43	0.29	0.34	0.08	0.10		61.0	0.33	0.38
02/21/11	Milo	D291	D	Cedar	46.8	55.8	0.48	0.57	0.45	0.53	0.23	0.28		81.0	0.76	0.90
02/21/11	Sorghum	D421	D	Dade	46.2	58.9	0.47	0.60	0.45	0.58	0.25	0.32		81.0	0.24	0.31
02/21/11	Fescue	D471	D	Dade	66.9	82.1	0.70	0.86	0.74	0.91	0.50	0.61		218.0	0.48	0.58

Sample Analyses of Crop Residues Collected in This Study

AR - as received OD - Oven Dried

Date	Crop	Sample ID:	Region	County	Phosphorus, %		Potassium, %		Magnesium, %		Sulfur, %		Sodium, %	
					AR	OD	AR	OD	AR	OD	AR	OD	AR	OD
12/09/10	Corn	A211	A	Newton	0.25	0.29	0.21	0.24	0.14	0.16	0.09	0.10	<0.01	0.01
12/09/10	Fescue	A271	A	Newton	0.30	0.43	0.36	0.51	0.15	0.21	0.14	0.20	<0.01	0.01
12/09/10	Milo	A291	A	Newton	0.17	0.27	0.36	0.56	0.14	0.22	0.10	0.15	<0.01	0.01
12/09/10	Corn	A411	A	Lawrence	0.10	0.14	0.73	1.04	0.05	0.07	0.06	0.09	<0.01	0.01
12/09/10	Soybeans	A441	A	Lawrence	0.22	0.28	1.02	1.30	0.19	0.24	0.09	0.11	<0.01	0.01
12/09/10	Native Grass	A481	A	Lawrence	0.16	0.19	0.26	0.30	0.15	0.17	0.10	0.12	<0.01	0.01
12/09/10	Corn	A511	A	Barry	0.06	0.08	0.19	0.24	0.06	0.08	0.06	0.08	<0.01	0.01
12/09/10	Soybeans	A541	A	Barry	0.19	0.23	0.55	0.66	0.23	0.28	0.10	0.12	<0.01	0.01
12/09/10	Fescue	A571	A	Barry	0.28	0.37	2.01	2.61	0.14	0.18	0.17	0.22	<0.01	0.01
12/09/10	Corn	D311	D	Barton	0.09	0.11	0.26	0.33	0.10	0.12	0.08	0.10	0.02	0.02
12/09/10	Wheat	D331	D	Barton	0.08	0.09	0.49	0.56	0.06	0.07	0.06	0.07	0.02	0.02
12/09/10	Soybeans	D341	D	Barton	0.08	0.09	0.10	0.11	0.17	0.20	0.05	0.06	<0.01	0.01
02/21/11	Sorghum	A121	A	Jasper	0.16	0.18	0.53	0.63	0.07	0.08	0.10	0.11	0.02	0.02
02/21/11	Native Grass	A181	A	Jasper	0.12	0.16	0.62	0.84	0.05	0.07	0.09	0.12	0.02	0.02
02/21/11	Milo	A191	A	Jasper	0.11	0.17	0.28	0.43	0.07	0.11	0.09	0.13	0.01	0.02
02/21/11	Sorghum	A321	A	McDonald	0.14	0.17	0.66	0.80	0.06	0.07	0.07	0.08	<0.01	0.01
02/21/11	Sorghum	C121	C	Polk	0.10	0.12	0.61	0.73	0.09	0.11	0.08	0.09	<0.01	0.01
02/21/11	Corn	C211	C	Dallas	0.29	0.33	0.33	0.38	0.09	0.10	0.06	0.07	<0.01	0.01
02/21/11	Fescue	C371	C	Green	0.25	0.33	0.32	0.41	0.14	0.19	0.12	0.15	<0.01	0.01
02/21/11	Fescue	C571	C	Wright	0.17	0.19	1.55	1.71	0.09	0.10	0.09	0.10	0.02	0.02
02/21/11	Corn	D111	D	Vernon	0.15	0.17	0.30	0.34	0.05	0.06	0.05	0.06	<0.01	0.01
02/21/11	Corn	D112	D	Vernon	0.42	0.48	0.32	0.37	0.15	0.17	0.12	0.14	<0.01	0.01
02/21/11	Fescue	D271	D	Cedar	0.14	0.16	0.98	1.14	0.08	0.09	0.10	0.11	0.02	0.02
02/21/11	Milo	D291	D	Cedar	0.12	0.14	0.17	0.20	0.08	0.09	0.11	0.13	<0.01	0.01
02/21/11	Sorghum	D421	D	Dade	0.08	0.10	0.35	0.44	0.07	0.09	0.06	0.08	<0.01	0.01
02/21/11	Fescue	D471	D	Dade	0.35	0.43	0.35	0.43	0.16	0.19	0.16	0.19	<0.01	0.01

Sample Analyses of Crop Residues Collected in This Study

AR - as received OD - Oven Dried

Date	Crop	Sample ID:	Region	County	Iron, mg/kg		Manganese, mg/kg		Zinc, mg/kg		Copper, mg/kg	
					AR	OD	AR	OD	AR	OD	AR	OD
12/09/10	Corn	A211	A	Newton	51.42	58.70	14.72	16.80	92.94	106.10	7.36	8.40
12/09/10	Fescue	A271	A	Newton	87.95	126.00	53.96	77.30	27.99	40.10	6.00	8.60
12/09/10	Milo	A291	A	Newton	73.16	115.40	23.27	36.70	19.97	31.50	6.66	10.50
12/09/10	Corn	A411	A	Lawrence	66.17	94.40	11.36	16.20	17.03	24.30	5.68	8.10
12/09/10	Soybeans	A441	A	Lawrence	69.90	89.50	14.37	18.40	14.37	18.40	6.17	7.90
12/09/10	Native Grass	A481	A	Lawrence	166.06	192.20	22.64	26.20	37.76	43.70	7.52	8.70
12/09/10	Corn	A511	A	Barry	209.62	260.40	35.74	44.40	30.99	38.50	4.75	5.90
12/09/10	Soybeans	A541	A	Barry	96.20	114.80	32.10	38.30	15.00	17.90	8.55	10.20
12/09/10	Fescue	A571	A	Barry	73.07	94.90	54.29	70.50	14.63	19.00	6.24	8.10
12/09/10	Corn	D311	D	Barton	202.93	254.30	28.73	36.00	53.31	66.80	4.07	5.10
12/09/10	Wheat	D331	D	Barton	107.20	122.10	15.28	17.40	10.18	11.60	5.09	5.80
12/09/10	Soybeans	D341	D	Barton	105.93	121.20	14.16	16.20	9.44	10.80	4.72	5.40
02/21/11	Sorghum	A121	A	Jasper	92.07	107.81	24.20	28.34	58.14	68.08	21.83	25.57
02/21/11	Native Grass	A181	A	Jasper	88.02	119.76	60.93	82.90	42.91	58.39	6.74	9.16
02/21/11	Milo	A191	A	Jasper	56.03	84.90	36.57	55.40	12.17	18.43	4.87	7.37
02/21/11	Sorghum	A321	A	McDonald	39.35	47.99	29.02	35.39	12.46	15.20	6.23	7.60
02/21/11	Sorghum	C121	C	Polk	59.41	70.73	87.18	103.79	31.73	37.77	5.93	7.06
02/21/11	Corn	C211	C	Dallas	46.61	53.15	18.13	20.67	98.50	112.31	10.36	11.81
02/21/11	Fescue	C371	C	Green	101.55	131.37	80.81	104.54	31.94	41.32	5.64	7.30
02/21/11	Fescue	C571	C	Wright	36.60	40.58	63.00	69.84	28.42	31.50	6.07	6.73
02/21/11	Corn	D111	D	Vernon	31.06	35.30	14.36	16.32	71.64	81.41	9.52	10.81
02/21/11	Corn	D112	D	Vernon	45.98	54.03	22.99	26.52	144.86	167.08	13.76	15.87
02/21/11	Fescue	D271	D	Cedar	42.40	48.96	52.15	60.22	6.56	7.58	6.56	7.58
02/21/11	Milo	D291	D	Cedar	50.64	60.28	44.54	53.03	8.07	9.60	4.03	4.80
02/21/11	Sorghum	D421	D	Dade	57.30	73.08	70.70	90.17	34.43	43.91	9.55	12.18
02/21/11	Fescue	D471	D	Dade	126.39	155.08	81.78	100.35	37.17	45.61	7.43	9.12

Harvesting and Transportation Costs

Data Source for Information: University of Illinois Extension[6]

Harvesting Costs - $7.40-9.80 per ton

Transportation ~ $1.00 per mile for Truck transportation

Sell @ $25/bale (1000#) 4x6 net strapped

Rake & Hay leaves 20% (or more) of residue on ground.

Semi-truck load ~ 36-48 tons – use 40 tons for analysis

Origination Sites are approximate quadrant centers of the regions to assist in determining transportation costs

Farmer Revenue for Crop Residues (per truckload) (40 – 1, 000 lb bales)				
	Harvesting Costs	Sales Price	Net Profit	Cost/Ton
Per truckload	$340	$1,000	$680	$50

Transportation Costs (not including sale price of crop residues) ($1.50 per mile for transportation costs)						
Origination Sites	Stotts City, MO (BioChoice)			Centerview, MO (ShowMe)		
		Cost	Cost/Ton		Cost	Cost/Ton
Grandby, MO	31 m	$46	$1.15	167 m	$150	$3.75
Brownbranch, MO	93 m	$140	$3.50	179 m	$264	$6.60
Marshfield, MO	66 m	$99	$2.48	124 m	$188	$4.70
Montevally, MO	53 m	$90	$2.25	113 m	$170	$4.25

Cost per Ton Delivered		
Origination Sites	Stotts City, MO (BioChoice)	Centerview, MO (ShowMe)
	Cost/Ton	Cost/Ton
Grandby, MO	$51.15	$53.75
Brownbranch, MO	$53.50	$56.60
Marshfield, MO	$52.48	$54.70
Montevally, MO	$52.25	$54.25

Analysis of Availability of Crop Residues in Southeast/Central Missouri with Characteristics for Use in Agricultural Based Fuel Pellet Production

This section provides some summary data of the Analysis of Availability of Crop Residues in Southeast/Central Missouri with Characteristics for Use in Agricultural Based Fuel Pellet Production.

The amount of crop residues available for harvesting can vary from 20% to 80%. The amount to be left on the fields for organic material replacement is more dependent upon the actual soil requirements. Monsanto's experts (including Mike Edgerton[7]) recommend a baseline of 20% crop residue left on the fields. Soil analysis is needed to determine how much is needed. Excess crop residues left in the field actually increase the amount of fertilizer (primarily Nitrogen) needed, as the organic matter consumes nitrogen in the composting cycle.

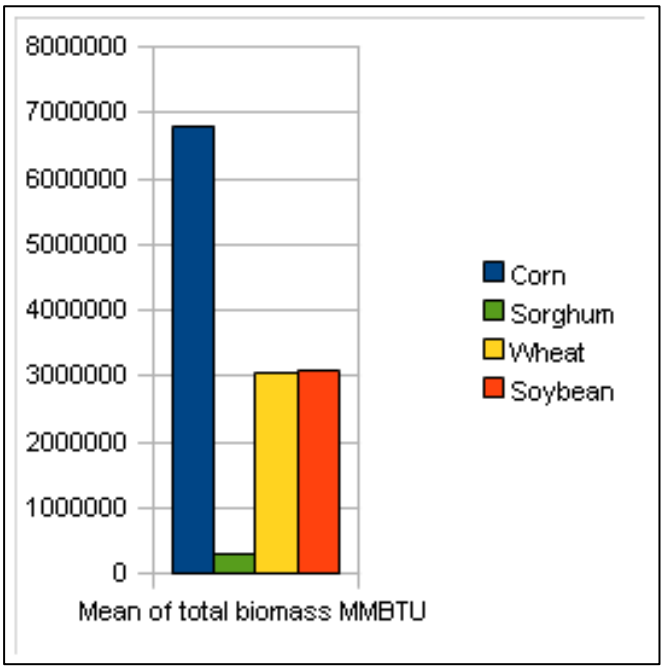
The crop residues left on the fields, after mowing and baling the residues can range from 10 to 67 percent with the average being about 28 percent.[8] Percent dry matter losses of hay from field to feeding:

CROP RESIDUES HARVESTING Amount Left on Fields	Range	Average
Mowing	1 - 6	3
Raking	5 - 20	3
Swathing with conditioner	1 - 10	10
Plant respiration	2 - 16	5
Baling, % of windrow	1 - 15	5
	10 - 67	28

In particular, crop residue harvest is complicated by the need for organic matter in the fields. The balance between too much and too little organic matter necessitates the need for crop residue selective harvesting– the variable requirement for harvest rate (lbs harvested per acre) is more accurately explained to be a function of the slope of the fields, farmer's management practices, biomass yield (that will vary), soil types, etc.[7]

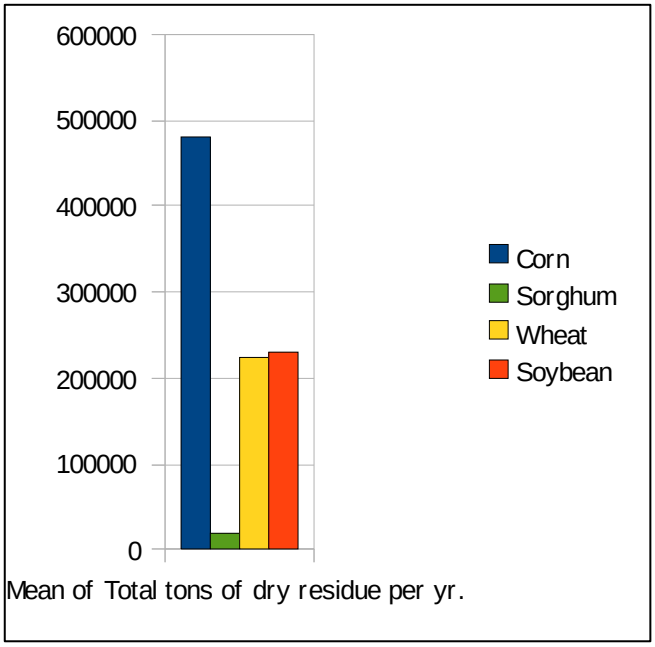
Charts & Maps – Summary of Results

(All data shown is the Mean of 2005-2010)



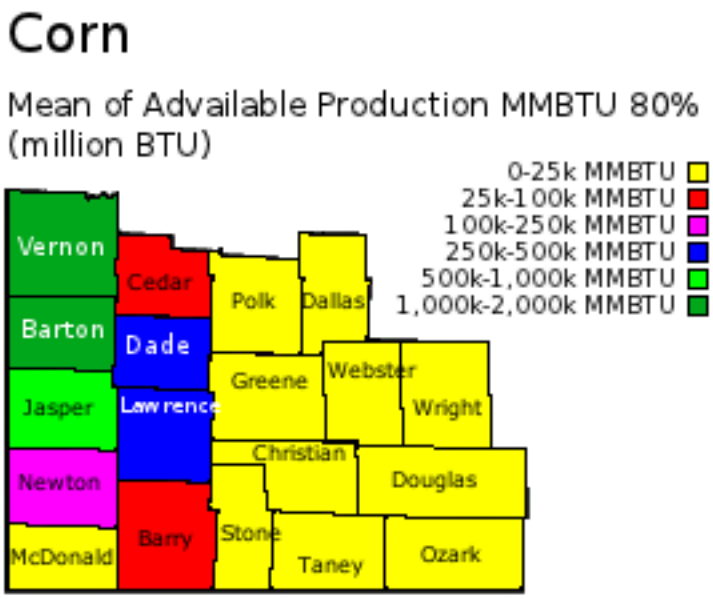
Mean of biomass Btu (million Btu)	
Corn	**6,803,969**
Sorghum	**286,359**
Wheat	**3,051,163**
Soybean	**3,078,272**

Mean of Total Tons of Dry Residue	
Corn	**481,868**
Sorghum	**19,091**
Wheat	**223,038**
Soybean	**231,102**

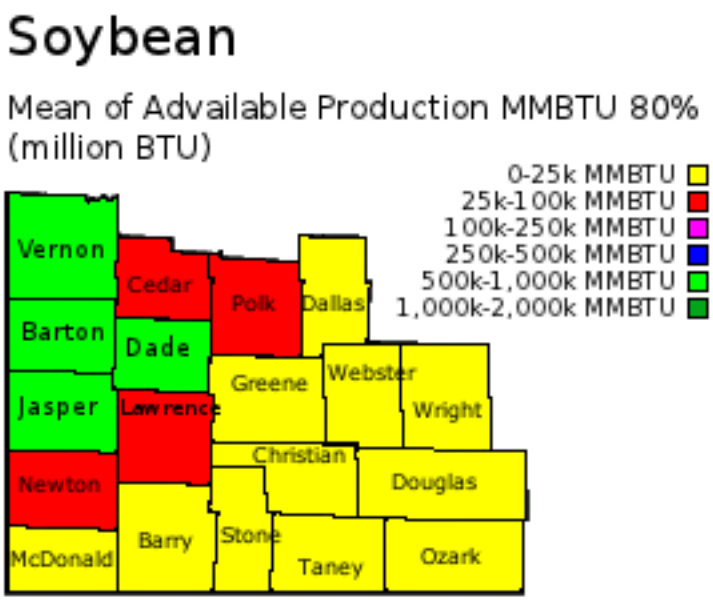


(Fescue not shown, due to insignificant data, and unable to vouch for reliability of projected data)

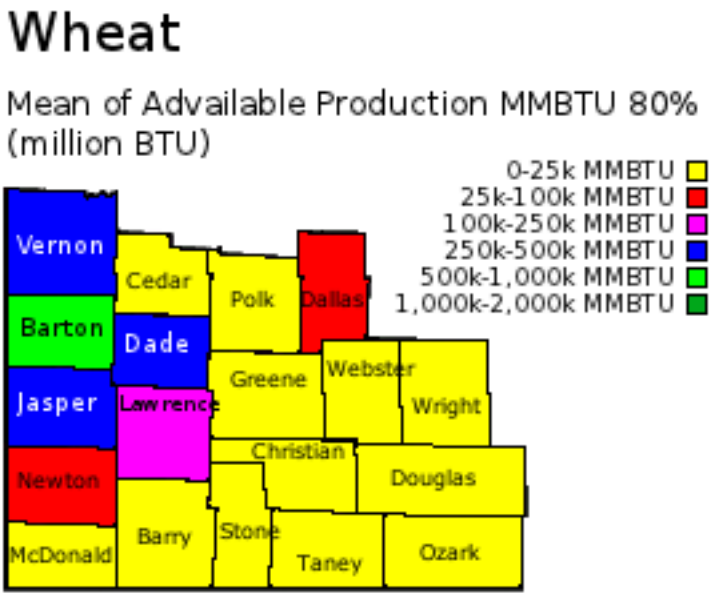
(The amount of corn residue available is 80% of total corn residue, the map shown uses the Mean of 2005-2010)



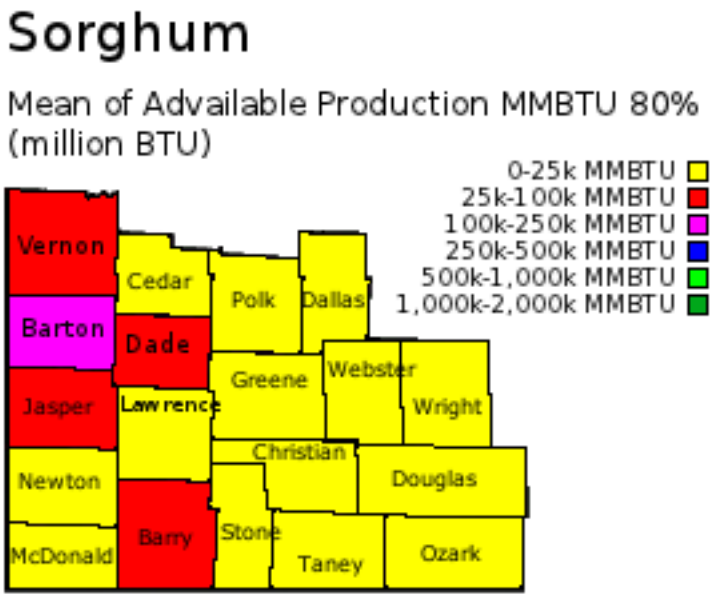
(The amount of soybean residue available is 80% of total soybean residue, the map shown uses the Mean of 2005-2010)



(The amount of wheat residue available is 80% of total wheat residue, the map shown uses the Mean of 2005-2010)



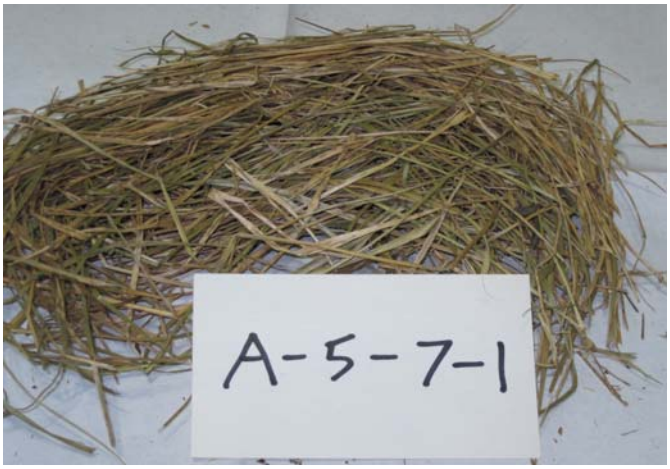
(The amount of sorghum residue available is 80% of total sorghum residue, the map shown uses the Mean of 2005-2010)



Pictures of Samples

Corn Samples (typical sample)

Fescue Samples (typical sample)



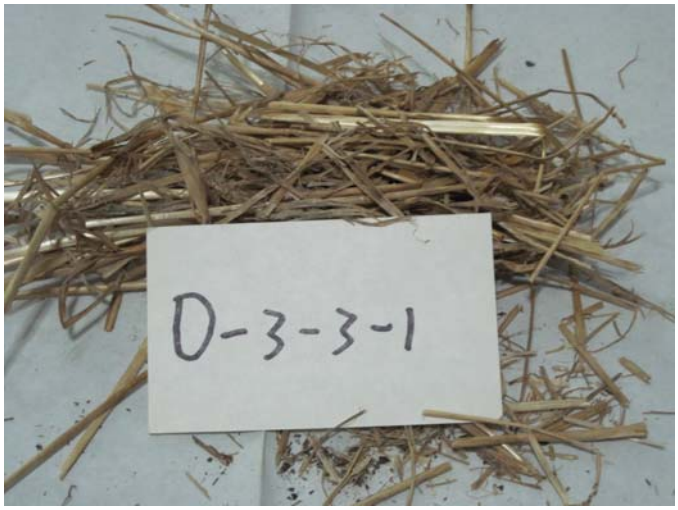
Milo Samples (typical sample)

Native Grass Samples (typical samples)

Sorghum Samples (typical samples)

Soybean Samples (typical samples)

Wheat Samples (typical samples)



TYPICAL YIELD TO RESIDUE RATIOS:

Table 1. Yield to Residue Ratios. [9]					
Crop	Corn	Grain sorghum	Winter Wheat	Rice	Soybeans
Ratio (straw/grain)	1.0 to 1	1.0 to 1	1.7 to 1	1.7 to 1	1.0 to 1
Pounds of grain/bushel	56	56	60	60	60

CORN DATA

HARVESTED ACRES - CORN

Corn — **Based on USDA Data[10]**

	Harvested Acres per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	2,400	0	1,700	3,000	3,500	3,000	2,267
Barton	43,900	42,800	39,000	40,700	48,500	55,100	45,000
Cedar	2,000	2,100	2,100	0	0	2,900	1,517
Christian	0	0	0	600	200	600	233
Dade	12,500	9,600	13,500	12,000	11,800	14,400	12,300
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	400	0	0	67
Jasper	19,200	21,400	22,400	21,600	26,200	28,100	23,150
Lawrence	6,100	5,800	6,700	7,500	7,800	8,400	7,050
McDonald	0	0	0	0	900	0	150
Newton	3,400	0	4,100	4,600	5,500	0	2,933
Ozark	0	0	0	0	0	0	0
Polk	1,800	0	0	0	0	0	300
Stone	0	0	0	0	0	300	50
Taney	0	0	0	0	0	0	0
Vernon	44,400	40,100	42,400	42,900	43,700	52,500	44,333
Webster	0		0	700	800	900	400
Wright	0			0	200	0	33
Totals	135,700	121,800	131,900	134,000	149,100	166,200	139,783

PRODUCTION (Bu/Yr) - CORN

Corn	Based on USDA Data[10]						
	Production (Bu)/yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	192,000	0	217,000	374,000	522,000	333,000	273,000
Barton	4,498,000	5,703,000	4,689,000	4,765,000	7,324,000	7,583,000	5,760,333
Cedar	169,000	209,000	247,000	0	0	367,000	165,333
Christian	0	0	0	80,000	24,000	59,900	27,317
Dade	832,000	1,256,000	1,626,000	1,363,000	1,817,000	1,552,000	1,407,667
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	50,000	0	0	8,333
Jasper	1,743,000	2,412,000	2,748,000	2,387,000	3,563,000	3,615,000	2,744,667
Lawrence	486,000	608,000	822,000	993,000	1,131,000	778,000	803,000
McDonald	0	0	0	0	108,000	0	18,000
Newton	232,000	0	581,000	603,000	731,000	0	357,833
Ozark	0	0	0	0	0	0	0
Polk	109,000	0	0	0	0	0	18,167
Stone	0	0	0	0	0	26,800	4,467
Taney	0	0	0	0	0	0	0
Vernon	5,513,000	4,814,000	5,526,000	5,097,000	5,900,000	6,451,000	5,550,167
Webster	0		0	86,000	108,000	103,500	49,583
Wright	0			0	31,000	0	5,167
Totals	13,774,000	15,002,000	16,456,000	15,798,000	21,259,000	20,869,200	17,193,033

YIELD (Bu/Acre) - CORN

Corn **Based on USDA Data[10]**

	Yield (Bu/Acre)						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	80.00	0.00	127.65	124.67	149.14	111.00	98.74
Barton	102.46	133.25	120.23	117.08	151.01	137.62	126.94
Cedar	84.50	99.52	117.62	0.00	0.00	126.55	71.37
Christian	0.00	0.00	0.00	133.33	120.00	99.83	58.86
Dade	66.56	130.83	120.44	113.58	153.98	107.78	115.53
Dallas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	0.00	0.00	0.00	125.00	0.00	0.00	20.83
Jasper	90.78	112.71	122.68	110.51	135.99	128.65	116.89
Lawrence	79.67	104.83	122.69	132.40	145.00	92.62	112.87
McDonald	0.00	0.00	0.00	0.00	120.00	0.00	20.00
Newton	68.24	0.00	141.71	131.09	132.91	0.00	78.99
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	60.56	0.00	0.00	0.00	0.00	0.00	10.09
Stone	0.00	0.00	0.00	0.00	0.00	89.33	14.89
Taney	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	124.17	120.05	130.33	118.81	135.01	122.88	125.21
Webster	0.00	0.00	0.00	122.86	135.00	115.00	62.14
Wright	0.00	0.00	0.00	0.00	155.00	0.00	25.83

YIELD (Tons/Acre) - CORN

Corn	**Based on USDA Data[10]**						
	Tons of residue per acre						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	2.24	0.00	3.58	3.49	4.18	3.11	2.77
Barton	2.87	3.73	3.37	3.28	4.23	3.86	3.56
Cedar	2.37	2.79	3.30	0.00	0.00	3.55	2.00
Christian	0.00	0.00	0.00	3.74	3.36	2.80	1.65
Dade	1.87	3.67	3.38	3.18	4.32	3.02	3.24
Dallas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	0.00	0.00	0.00	3.50	0.00	0.00	0.58
Jasper	2.54	3.16	3.44	3.10	3.81	3.61	3.28
Lawrence	2.23	2.94	3.44	3.71	4.06	2.60	3.16
McDonald	0.00	0.00	0.00	0.00	3.36	0.00	0.56
Newton	1.91	0.00	3.97	3.67	3.73	0.00	2.21
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	1.70	0.00	0.00	0.00	0.00	0.00	0.28
Stone	0.00	0.00	0.00	0.00	0.00	2.50	0.42
Taney	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	3.48	3.36	3.65	3.33	3.78	3.44	3.51
Webster	0.00	0.00	0.00	3.44	3.78	3.22	1.74
Wright	0.00	0.00	0.00	0.00	4.34	0.00	0.72

YIELD (Total Dry Tons/Year) - CORN

Corn **Based on USDA Data[10]**

	Total dry tons of residue per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	5,381	0	6,082	10,482	14,630	9,333	7,651
Barton	126,065	159,837	131,418	133,548	205,269	212,528	161,444
Cedar	4,737	5,858	6,923	0	0	10,286	4,634
Christian	0	0	0	2,242	673	1,679	766
Dade	23,318	35,202	45,572	38,201	50,925	43,498	39,453
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	1,401	0	0	234
Jasper	48,851	67,601	77,018	66,900	99,860	101,317	76,925
Lawrence	13,621	17,040	23,038	27,831	31,698	21,805	22,506
McDonald	0	0	0	0	3,027	0	504
Newton	6,502	0	16,284	16,900	20,488	0	10,029
Ozark	0	0	0	0	0	0	0
Polk	3,055	0	0	0	0	0	509
Stone	0	0	0	0	0	751	125
Taney	0	0	0	0	0	0	0
Vernon	154,512	134,922	154,877	142,853	165,359	180,802	155,554
Webster	0	0	0	2,410	3,027	2,901	1,390
Wright	0	0	0	0	869	0	145
Totals	386,043	420,460	461,211	442,769	595,824	584,899	481,868

YIELD (Total Biomass MMBTU/Year) - CORN

Corn **Based on USDA Data[10]**

	Total biomass production MMBTU						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	75,982	0	85,876	148,007	206,576	131,781	108,037
Barton	1,780,038	2,256,905	1,855,624	1,885,701	2,898,399	3,000,896	2,279,594
Cedar	66,880	82,710	97,748	0	0	145,237	65,429
Christian	0	0	0	31,659	9,498	23,705	10,810
Dade	329,256	497,049	643,473	539,393	719,059	614,188	557,070
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	19,787	0	0	3,298
Jasper	689,775	954,525	1,087,493	944,631	1,410,021	1,430,600	1,086,174
Lawrence	192,330	240,610	325,298	392,970	447,582	307,886	317,779
McDonald	0	0	0	0	42,740	0	7,123
Newton	91,812	0	229,925	238,631	289,286	0	141,609
Ozark	0	0	0	0	0	0	0
Polk	43,136	0	0	0	0	0	7,189
Stone	0	0	0	0	0	10,606	1,768
Taney	0	0	0	0	0	0	0
Vernon	2,181,714	1,905,092	2,186,859	2,017,086	2,334,865	2,552,918	2,196,422
Webster	0	0	0	34,034	42,740	40,959	19,622
Wright	0	0	0	0	12,268	0	2,045
Totals	5,450,922	5,936,890	6,512,296	6,251,899	8,413,035	8,258,775	6,803,969

YIELD (Total Biomass MMBTU/Year @ 80% removal) - CORN

Corn **Based on USDA Data[10]**

	Available production MMBTU 80%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	60,786	0	68,700	118,405	165,261	105,425	86,430
Barton	1,424,030	1,805,524	1,484,500	1,508,561	2,318,719	2,400,717	1,823,675
Cedar	53,504	66,168	78,198	0	0	116,189	52,343
Christian	0	0	0	25,327	7,598	18,964	8,648
Dade	263,404	397,639	514,778	431,515	575,248	491,351	445,656
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	15,830	0	0	2,638
Jasper	551,820	763,620	869,995	755,705	1,128,017	1,144,480	868,939
Lawrence	153,864	192,488	260,239	314,376	358,065	246,309	254,223
McDonald	0	0	0	0	34,192	0	5,699
Newton	73,449	0	183,940	190,905	231,429	0	113,287
Ozark	0	0	0	0	0	0	0
Polk	34,509	0	0	0	0	0	5,751
Stone	0	0	0	0	0	8,485	1,414
Taney	0	0	0	0	0	0	0
Vernon	1,745,371	1,524,074	1,749,487	1,613,669	1,867,892	2,042,335	1,757,138
Webster	0	0	0	27,227	34,192	32,767	15,698
Wright	0	0	0	0	9,814	0	1,636
Totals	4,360,737	4,749,512	5,209,837	5,001,519	6,730,428	6,607,020	5,443,176

YIELD (Total Biomass MMBTU/Year @ 50% removal) - CORN

Corn	**Based on USDA[10]**						
	Available production MMBTU 50%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	37,991	0	42,938	74,003	103,288	65,891	54,018
Barton	890,019	1,128,452	927,812	942,850	1,449,200	1,500,448	1,139,797
Cedar	33,440	41,355	48,874	0	0	72,618	32,714
Christian	0	0	0	15,830	4,749	11,852	5,405
Dade	164,628	248,525	321,737	269,697	359,530	307,094	278,535
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	9,893	0	0	1,649
Jasper	344,887	477,262	543,747	472,316	705,011	715,300	543,087
Lawrence	96,165	120,305	162,649	196,485	223,791	153,943	158,890
McDonald	0	0	0	0	21,370	0	3,562
Newton	45,906	0	114,962	119,316	144,643	0	70,804
Ozark	0	0	0	0	0	0	0
Polk	21,568	0	0	0	0	0	3,595
Stone	0	0	0	0	0	5,303	884
Taney	0	0	0	0	0	0	0
Vernon	1,090,857	952,546	1,093,429	1,008,543	1,167,433	1,276,459	1,098,211
Webster	0	0	0	17,017	21,370	20,480	9,811
Wright	0	0	0	0	6,134	0	1,022
Totals	2,725,461	2,968,445	3,256,148	3,125,950	4,206,517	4,129,388	3,401,985

YIELD (Total Biomass MMBTU/Year @ 20% removal) - CORN

Corn **Based on USDA Data[10]**

	Available production MMBTU 20%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	15,196	0	17,175	29,601	41,315	26,356	21,607
Barton	356,008	451,381	371,125	377,140	579,680	600,179	455,919
Cedar	13,376	16,542	19,550	0	0	29,047	13,086
Christian	0	0	0	6,332	1,900	4,741	2,162
Dade	65,851	99,410	128,695	107,879	143,812	122,838	111,414
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	3,957	0	0	660
Jasper	137,955	190,905	217,499	188,926	282,004	286,120	217,235
Lawrence	38,466	48,122	65,060	78,594	89,516	61,577	63,556
McDonald	0	0	0	0	8,548	0	1,425
Newton	18,362	0	45,985	47,726	57,857	0	28,322
Ozark	0	0	0	0	0	0	0
Polk	8,627	0	0	0	0	0	1,438
Stone	0	0	0	0	0	2,121	354
Taney	0	0	0	0	0	0	0
Vernon	436,343	381,018	437,372	403,417	466,973	510,584	439,284
Webster	0	0	0	6,807	8,548	8,192	3,924
Wright	0	0	0	0	2,454	0	409
Totals	1,090,184	1,187,378	1,302,459	1,250,380	1,682,607	1,651,755	1,360,794

SORGHUM DATA

YIELD (Harvested Acres/Year) - SORGHUM

Sorghum — **Based on USDA Data**[10]

	Harvested Acres per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	8,500	4,950	3,500	3,200	3,200	2,000	4,225
Cedar	0	0	600	0	0	0	100
Christian	0	0	0	0	0	0	0
Dade	2,600	2,000	1,300	800	1,000	900	1,433
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	1,700	1,700	3,100	0	700	500	1,283
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	2,800	1,000	1,200	600	1,400	1,000	1,333
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	15,600	9,650	9,700	4,600	6,300	4,400	8,375

YIELD (Production Bu/Year) - SORGHUM

Sorghum **Based on USDA Data[10]**

	Production (Bu)/yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	557,000	295,000	322,000	300,100	338,000	137,000	324,850
Cedar	0	0	72,000	0	0	0	12,000
Christian	0	0	0	0	0	0	0
Dade	154,000	112,000	117,000	84,000	124,000	80,400	111,900
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	133,000	120,000	362,800	0	63,000	38,900	119,617
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	226,000	78,000	144,000	48,000	115,000	68,000	113,167
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	1,070,000	605,000	1,017,800	432,100	640,000	324,300	681,533

YIELD (Bu/Acre) – SORGHUM

Sorghum **Based on USDA Data[10]**

	Yield (Bu/Acre)						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barton	65.53	59.60	92.00	93.78	105.63	68.50	80.84
Cedar	0.00	0.00	120.00	0.00	0.00	0.00	20.00
Christian	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dade	59.23	56.00	90.00	105.00	124.00	89.33	87.26
Dallas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jasper	78.24	70.59	117.03	0.00	90.00	77.80	72.28
Lawrence	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McDonald	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Newton	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taney	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	80.71	78.00	120.00	80.00	82.14	68.00	84.81
Webster	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wright	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YIELD (Tons Residue/Acre) – SORGHUM

Sorghum	**Based on USDA Data[10]**						
	Tons of residue per acre						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barton	1.84	1.67	2.58	2.63	2.96	1.92	2.26
Cedar	0.00	0.00	3.36	0.00	0.00	0.00	0.56
Christian	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dade	1.66	1.57	2.52	2.94	3.47	2.50	2.44
Dallas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jasper	2.19	1.98	3.28	0.00	2.52	2.18	2.02
Lawrence	0.00	0.00	0.00	0.00	0.00	0.00	0.00
McDonald	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Newton	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taney	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	2.26	2.18	3.36	2.24	2.30	1.90	2.38
Webster	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wright	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YIELD (Total Dry Tons Residue/Year) - SORGHUM

Sorghum	**Based on USDA Data[10]**						
	Total dry tons of residue per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	15,602	8,263	9,020	8,406	9,468	3,838	9,099
Cedar	0	0	2,017	0	0	0	336
Christian	0	0	0	0	0	0	0
Dade	4,314	3,137	3,277	2,353	3,473	2,252	3,134
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	3,725	3,361	10,162	0	1,765	1,090	3,351
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	6,331	2,185	4,034	1,345	3,221	1,905	3,170
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	29,972	16,947	28,510	12,104	17,927	9,084	19,091

YIELD (MMBtu/Year) - SORGHUM

Sorghum	**Based on USDA Data[10]**						
	Total biomass production MMBTU						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	234,034	123,950	135,294	126,092	142,017	57,563	136,492
Cedar	0	0	30,252	0	0	0	5,042
Christian	0	0	0	0	0	0	0
Dade	64,706	47,059	49,160	35,294	52,101	33,782	47,017
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	55,882	50,420	152,437	0	26,471	16,345	50,259
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	94,958	32,773	60,504	20,168	48,319	28,571	47,549
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	449,580	254,202	427,647	181,555	268,908	136,261	286,359

YIELD (Total Biomass MMBTU/Year @ 80% removal) - SORGHUM

Sorghum	**Based on USDA Data[10]**						
	Available production MMBTU 80%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	187,227	99,160	108,235	100,874	113,613	46,050	109,193
Cedar	0	0	24,202	0	0	0	4,034
Christian	0	0	0	0	0	0	0
Dade	51,765	37,647	39,328	28,235	41,681	27,025	37,613
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	44,706	40,336	121,950	0	21,176	13,076	40,207
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	75,966	26,218	48,403	16,134	38,655	22,857	38,039
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	359,664	203,361	342,118	145,244	215,126	109,008	229,087

YIELD (Total Biomass MMBTU/Year @ 50% removal) - SORGHUM

Sorghum	**Based on USDA Data[10]**						
	Available production MMBTU 50%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	117,017	61,975	67,647	63,046	71,008	28,782	68,246
Cedar	0	0	15,126	0	0	0	2,521
Christian	0	0	0	0	0	0	0
Dade	32,353	23,529	24,580	17,647	26,050	16,891	23,508
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	27,941	25,210	76,218	0	13,235	8,172	25,130
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	47,479	16,387	30,252	10,084	24,160	14,286	23,775
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	224,790	127,101	213,824	90,777	134,454	68,130	143,179

YIELD (Total Biomass MMBTU/Year @ 20% removal) - SORGHUM

Sorghum	**Based on USDA Data[10]**						
	Available production MMBTU 20%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0	0	0	0	0	0	0
Barton	46,807	24,790	27,059	25,218	28,403	11,513	27,298
Cedar	0	0	6,050	0	0	0	1,008
Christian	0	0	0	0	0	0	0
Dade	12,941	9,412	9,832	7,059	10,420	6,756	9,403
Dallas	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0
Jasper	11,176	10,084	30,487	0	5,294	3,269	10,052
Lawrence	0	0	0	0	0	0	0
McDonald	0	0	0	0	0	0	0
Newton	0	0	0	0	0	0	0
Ozark	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	18,992	6,555	12,101	4,034	9,664	5,714	9,510
Webster	0	0	0	0	0	0	0
Wright	0	0	0	0	0	0	0
Totals	89,916	50,840	85,529	36,311	53,782	27,252	57,272

WHEAT DATA

YIELD (Harvested Acres/Year) - WHEAT

Wheat **Based on USDA Data[10]**

	Harvested Acres per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	500	900	1,000	1,000	1,200	0	767
Barton	35,300	49,100	47,300	51,600	39,000	0	37,050
Cedar	0	1,000	1,200	1,300	700	400	767
Christian	300	0	0	0	0	0	50
Dade	13,300	20,300	24,600	24,800	23,700	9,500	19,367
Dallas	0	0	8,300	0	0	0	1,383
Douglas	0	0	0	0	0	0	0
Greene	600	0	600	600	1,000	700	583
Jasper	18,300	27,300	27,500	27,500	26,700	13,700	23,500
Lawrence	5,000	5,600	6,500	5,100	5,900	3,800	5,317
McDonald	0	0	0	100	0	0	17
Newton	2,900	4,200	5,300	3,100	4,000	1,900	3,567
Ozark	0	0	0	0	0	0	0
Polk	1,000	1,300	0	1,800	1,000	0	850
Stone	0	0	0	0	0	0	0
Taney	300	0	0	0	0	0	50
Vernon	19,200	24,100	27,200	29,700	19,300	3,300	20,467
Webster	200	500	800	600	300	300	450
Wright	0	0	0	0	0	0	0
Totals	96,900	134,300	150,300	147,200	122,800	33,600	114,183

YIELD (Production Bu/Year) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Production (Bu)/yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	20,000	50,000	27,300	38,700	45,500	0	30,250
Barton	1,841,000	1,455,000	1,299,000	2,180,000	1,769,400	0	1,424,067
Cedar	0	30,000	42,500	50,300	26,900	14,000	27,283
Christian	15,000	0	0	0	0	0	2,500
Dade	640,000	647,000	756,500	1,049,000	1,127,800	297,000	752,883
Dallas	0	0	366,100	0	0	0	61,017
Douglas	0	0	0	0	0	0	0
Greene	26,000	0	19,900	27,300	40,000	28,200	23,567
Jasper	840,000	730,000	722,000	1,154,000	1,277,100	502,000	870,850
Lawrence	215,000	210,000	222,200	219,500	247,800	145,000	209,917
McDonald	0	0	0	2,400	0	0	400
Newton	145,000	140,000	146,800	129,600	151,600	74,500	131,250
Ozark	0	0	0	0	0	0	0
Polk	36,000	45,000	0	77,500	40,000	0	33,083
Stone	0	0	0	0	0	0	0
Taney	15,000	0	0	0	0	0	2,500
Vernon	944,000	865,000	768,500	1,286,000	774,300	87,200	787,500
Webster	8,000	30,000	14,900	20,800	12,000	11,900	16,267
Wright	0	0	0	0	0	0	0
Totals	4,745,000	4,202,000	4,385,700	6,235,100	5,512,400	1,159,800	4,373,333

YIELD (Bu/Acre) - WHEAT

Wheat **Based on USDA Data[10]**

	Yield (Bu/Acre)						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	40.00	55.56	27.30	38.70	37.92	0.00	33.25
Barton	52.15	29.63	27.46	42.25	45.37	0.00	32.81
Cedar	0.00	30.00	35.42	38.69	38.43	35.00	29.59
Christian	50.00	0.00	0.00	0.00	0.00	0.00	8.33
Dade	48.12	31.87	30.75	42.30	47.59	31.26	38.65
Dallas	0.00	0.00	44.11	0.00	0.00	0.00	7.35
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	43.33	0.00	33.17	45.50	40.00	40.29	33.71
Jasper	45.90	26.74	26.25	41.96	47.83	36.64	37.56
Lawrence	43.00	37.50	34.18	43.04	42.00	38.16	39.65
McDonald	0.00	0.00	0.00	24.00	0.00	0.00	4.00
Newton	50.00	33.33	27.70	41.81	37.90	39.21	38.32
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	36.00	34.62	0.00	43.06	40.00	0.00	25.61
Stone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taney	50.00	0.00	0.00	0.00	0.00	0.00	8.33
Vernon	49.17	35.89	28.25	43.30	40.12	26.42	37.19
Webster	40.00	60.00	18.63	34.67	40.00	39.67	38.83
Wright	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YIELD (Tons of Residue/Acre) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Tons of residue per acre						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	2.04	2.83	1.39	1.97	1.93	0.00	1.70
Barton	2.66	1.51	1.40	2.15	2.31	0.00	1.67
Cedar	0.00	1.53	1.81	1.97	1.96	1.78	1.51
Christian	2.55	0.00	0.00	0.00	0.00	0.00	0.42
Dade	2.45	1.63	1.57	2.16	2.43	1.59	1.97
Dallas	0.00	0.00	2.25	0.00	0.00	0.00	0.37
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	2.21	0.00	1.69	2.32	2.04	2.05	1.72
Jasper	2.34	1.36	1.34	2.14	2.44	1.87	1.92
Lawrence	2.19	1.91	1.74	2.19	2.14	1.95	2.02
McDonald	0.00	0.00	0.00	1.22	0.00	0.00	0.20
Newton	2.55	1.70	1.41	2.13	1.93	2.00	1.95
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	1.84	1.77	0.00	2.20	2.04	0.00	1.31
Stone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taney	2.55	0.00	0.00	0.00	0.00	0.00	0.42
Vernon	2.51	1.83	1.44	2.21	2.05	1.35	1.90
Webster	2.04	3.06	0.95	1.77	2.04	2.02	1.98
Wright	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YIELD (Total Dry Tons/Year) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Total dry tons of residue per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	1,020	2,550	1,392	1,974	2,320	0	1,543
Barton	93,890	74,204	66,248	111,179	90,239	0	72,627
Cedar	0	1,530	2,167	2,565	1,372	714	1,391
Christian	765	0	0	0	0	0	127
Dade	32,640	32,997	38,581	53,499	57,517	15,147	38,397
Dallas	0	0	18,671	0	0	0	3,112
Douglas	0	0	0	0	0	0	0
Greene	1,326	0	1,015	1,392	2,040	1,438	1,202
Jasper	42,840	37,230	36,822	58,854	65,132	25,602	44,413
Lawrence	10,965	10,710	11,332	11,194	12,638	7,395	10,706
McDonald	0	0	0	122	0	0	20
Newton	7,395	7,140	7,487	6,610	7,732	3,799	6,694
Ozark	0	0	0	0	0	0	0
Polk	1,836	2,295	0	3,952	2,040	0	1,687
Stone	0	0	0	0	0	0	0
Taney	765	0	0	0	0	0	127
Vernon	48,144	44,115	39,193	65,585	39,489	4,447	40,162
Webster	408	1,530	760	1,061	612	607	830
Wright	0	0	0	0	0	0	0
Totals	241,993	214,300	223,669	317,988	281,130	59,149	223,038

YIELD (MMBTU/Year) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Total biomass production MMBTU						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	13,953	34,884	19,047	27,000	31,744	0	21,105
Barton	1,284,419	1,015,116	906,279	1,520,930	1,234,465	0	993,535
Cedar	0	20,930	29,651	35,093	18,767	9,767	19,035
Christian	10,465	0	0	0	0	0	1,744
Dade	446,512	451,395	527,791	731,860	786,837	207,209	525,267
Dallas	0	0	255,419	0	0	0	42,570
Douglas	0	0	0	0	0	0	0
Greene	18,140	0	13,884	19,047	27,907	19,674	16,442
Jasper	586,047	509,302	503,721	805,116	891,000	350,233	607,570
Lawrence	150,000	146,512	155,023	153,140	172,884	101,163	146,453
McDonald	0	0	0	1,674	0	0	279
Newton	101,163	97,674	102,419	90,419	105,767	51,977	91,570
Ozark	0	0	0	0	0	0	0
Polk	25,116	31,395	0	54,070	27,907	0	23,081
Stone	0	0	0	0	0	0	0
Taney	10,465	0	0	0	0	0	1,744
Vernon	658,605	603,488	536,163	897,209	540,209	60,837	549,419
Webster	5,581	20,930	10,395	14,512	8,372	8,302	11,349
Wright	0	0	0	0	0	0	0
Totals	3,310,465	2,931,628	3,059,791	4,350,070	3,845,860	809,163	3,051,163

YIELD (Total Biomass MMBTU/Year @ 80% removal) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Available production MMBTU 80%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	11,163	27,907	15,237	21,600	25,395	0	16,884
Barton	1,027,535	812,093	725,023	1,216,744	987,572	0	794,828
Cedar	0	16,744	23,721	28,074	15,014	7,814	15,228
Christian	8,372	0	0	0	0	0	1,395
Dade	357,209	361,116	422,233	585,488	629,470	165,767	420,214
Dallas	0	0	204,335	0	0	0	34,056
Douglas	0	0	0	0	0	0	0
Greene	14,512	0	11,107	15,237	22,326	15,740	13,153
Jasper	468,837	407,442	402,977	644,093	712,800	280,186	486,056
Lawrence	120,000	117,209	124,019	122,512	138,307	80,930	117,163
McDonald	0	0	0	1,340	0	0	223
Newton	80,930	78,140	81,935	72,335	84,614	41,581	73,256
Ozark	0	0	0	0	0	0	0
Polk	20,093	25,116	0	43,256	22,326	0	18,465
Stone	0	0	0	0	0	0	0
Taney	8,372	0	0	0	0	0	1,395
Vernon	526,884	482,791	428,930	717,767	432,167	48,670	439,535
Webster	4,465	16,744	8,316	11,609	6,698	6,642	9,079
Wright	0	0	0	0	0	0	0
Totals	2,648,372	2,345,302	2,447,833	3,480,056	3,076,688	647,330	2,440,930

YIELD (Total Biomass MMBTU/Year @ 50% removal) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Available production MMBTU 50%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	6,977	17,442	9,523	13,500	15,872	0	10,552
Barton	642,209	507,558	453,140	760,465	617,233	0	496,767
Cedar	0	10,465	14,826	17,547	9,384	4,884	9,517
Christian	5,233	0	0	0	0	0	872
Dade	223,256	225,698	263,895	365,930	393,419	103,605	262,634
Dallas	0	0	127,709	0	0	0	21,285
Douglas	0	0	0	0	0	0	0
Greene	9,070	0	6,942	9,523	13,953	9,837	8,221
Jasper	293,023	254,651	251,860	402,558	445,500	175,116	303,785
Lawrence	75,000	73,256	77,512	76,570	86,442	50,581	73,227
McDonald	0	0	0	837	0	0	140
Newton	50,581	48,837	51,209	45,209	52,884	25,988	45,785
Ozark	0	0	0	0	0	0	0
Polk	12,558	15,698	0	27,035	13,953	0	11,541
Stone	0	0	0	0	0	0	0
Taney	5,233	0	0	0	0	0	872
Vernon	329,302	301,744	268,081	448,605	270,105	30,419	274,709
Webster	2,791	10,465	5,198	7,256	4,186	4,151	5,674
Wright	0	0	0	0	0	0	0
Totals	1,655,233	1,465,814	1,529,895	2,175,035	1,922,930	404,581	1,525,581

YIELD (Total Biomass MMBTU/Year @ 20% removal) - WHEAT

Wheat	**Based on USDA Data[10]**						
	Available production MMBTU 20%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	2,791	6,977	3,809	5,400	6,349	0	4,221
Barton	256,884	203,023	181,256	304,186	246,893	0	198,707
Cedar	0	4,186	5,930	7,019	3,753	1,953	3,807
Christian	2,093	0	0	0	0	0	349
Dade	89,302	90,279	105,558	146,372	157,367	41,442	105,053
Dallas	0	0	51,084	0	0	0	8,514
Douglas	0	0	0	0	0	0	0
Greene	3,628	0	2,777	3,809	5,581	3,935	3,288
Jasper	117,209	101,860	100,744	161,023	178,200	70,047	121,514
Lawrence	30,000	29,302	31,005	30,628	34,577	20,233	29,291
McDonald	0	0	0	335	0	0	56
Newton	20,233	19,535	20,484	18,084	21,153	10,395	18,314
Ozark	0	0	0	0	0	0	0
Polk	5,023	6,279	0	10,814	5,581	0	4,616
Stone	0	0	0	0	0	0	0
Taney	2,093	0	0	0	0	0	349
Vernon	131,721	120,698	107,233	179,442	108,042	12,167	109,884
Webster	1,116	4,186	2,079	2,902	1,674	1,660	2,270
Wright	0	0	0	0	0	0	0
Totals	662,093	586,326	611,958	870,014	769,172	161,833	610,233

SOYBEAN DATA

YIELD (Harvested Acres/Year) - SOYBEAN

Soybean	Based on USDA Data[10]						
	Harvested Acres per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	500	0	0	700	1,600	1,900	783
Barton	73,200	75,600	68,400	81,300	79,800	78,200	76,083
Cedar	4,900	4,800	3,300	5,100	0	5,600	3,950
Christian	0	0	0	0	0	0	0
Dade	25,700	26,800	22,100	29,100	28,300	26,600	26,433
Dallas	0	0	0	0	0	1,400	233
Douglas	0	0	0	0	0	0	0
Greene	400	0	0	0	0	1,700	350
Jasper	41,000	42,800	37,400	44,900	46,600	45,400	43,017
Lawrence	7,000	7,400	6,700	7,800	8,900	9,300	7,850
McDonald	0	0	0	0	0	0	0
Newton	3,100	3,200	3,600	3,400	4,800	5,000	3,850
Ozark	0	0	0	0	0	0	0
Polk	2,100	1,600	1,400	2,700	3,500	4,100	2,567
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	71,400	74,300	56,400	71,300	78,800	75,900	71,350
Webster	0	0	0	500	600	900	333
Wright	0	0	0	0	0	0	0
Totals	229,300	236,500	199,300	246,800	252,900	256,000	236,800

YIELD (Bu/Acre) - SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Production (Bu)/yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	13,000	0	0	32,900	50,000	58,000	25,650
Barton	1,949,000	1,624,000	2,340,000	2,764,000	2,953,000	2,850,000	2,413,333
Cedar	150,000	90,000	106,000	143,000	0	190,000	113,167
Christian	0	0	0	0	0	0	0
Dade	753,000	520,000	703,000	1,075,000	1,160,000	918,000	854,833
Dallas	0	0	0	0	0	45,000	7,500
Douglas	0	0	0	0	0	0	0
Greene	13,000	0	0	0	0	51,000	10,667
Jasper	1,259,000	755,000	1,496,000	1,832,000	1,792,000	1,532,000	1,444,333
Lawrence	177,000	175,000	245,000	273,100	373,200	278,000	253,550
McDonald	0	0	0	0	0	0	0
Newton	83,000	75,000	127,000	125,600	196,400	137,000	124,000
Ozark	0	0	0	0	0	0	0
Polk	58,000	40,000	45,000	98,800	141,600	145,000	88,067
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	2,538,000	1,459,000	1,861,000	2,359,000	3,271,800	2,649,000	2,356,300
Webster	0	0	0	21,600	21,300	29,000	11,983
Wright	0	0	0	0	0	0	0
Totals	6,993,000	4,738,000	6,923,000	8,725,000	9,959,300	8,882,000	7,703,383

YIELD (Bu/Acre) - SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Yield (Bu/Acre)						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	26.00	0.00	0.00	47.00	31.25	30.53	22.46
Barton	26.63	21.48	34.21	34.00	37.01	36.45	31.63
Cedar	30.61	18.75	32.12	28.04	0.00	33.93	23.91
Christian	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dade	29.30	19.40	31.81	36.94	40.99	34.51	32.16
Dallas	0.00	0.00	0.00	0.00	0.00	32.14	5.36
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	32.50	0.00	0.00	0.00	0.00	30.00	10.42
Jasper	30.71	17.64	40.00	40.80	38.45	33.74	33.56
Lawrence	25.29	23.65	36.57	35.01	41.93	29.89	32.06
McDonald	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Newton	26.77	23.44	35.28	36.94	40.92	27.40	31.79
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	27.62	25.00	32.14	36.59	40.46	35.37	32.86
Stone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taney	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	35.55	19.64	33.00	33.09	41.52	34.90	32.95
Webster	0.00	0.00	0.00	43.20	35.50	32.22	18.49
Wright	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YIELD (Tons Residue/Acre) - SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Tons of residue per acre						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	0.78	0.00	0.00	1.41	0.94	0.92	0.67
Barton	0.80	0.64	1.03	1.02	1.11	1.09	0.95
Cedar	0.92	0.56	0.96	0.84	0.00	1.02	0.72
Christian	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dade	0.88	0.58	0.95	1.11	1.23	1.04	0.96
Dallas	0.00	0.00	0.00	0.00	0.00	0.96	0.16
Douglas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greene	0.98	0.00	0.00	0.00	0.00	0.90	0.31
Jasper	0.92	0.53	1.20	1.22	1.15	1.01	1.01
Lawrence	0.76	0.71	1.10	1.05	1.26	0.90	0.96
McDonald	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Newton	0.80	0.70	1.06	1.11	1.23	0.82	0.95
Ozark	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polk	0.83	0.75	0.96	1.10	1.21	1.06	0.99
Stone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taney	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vernon	1.07	0.59	0.99	0.99	1.25	1.05	0.99
Webster	0.00	0.00	0.00	1.30	1.07	0.97	0.55
Wright	0.00	0.00	0.00	0.00	0.00	0.00	0.00

YIELD (Dry Tons Residue/Year) - SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Total dry tons of residue per yr.						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	390	0	0	987	1,500	1,740	770
Barton	58,470	48,720	70,200	82,920	88,590	85,500	72,400
Cedar	4,500	2,700	3,180	4,290	0	5,700	3,395
Christian	0	0	0	0	0	0	0
Dade	22,590	15,600	21,090	32,250	34,800	27,540	25,645
Dallas	0	0	0	0	0	1,350	225
Douglas	0	0	0	0	0	0	0
Greene	390	0	0	0	0	1,530	320
Jasper	37,770	22,650	44,880	54,960	53,760	45,960	43,330
Lawrence	5,310	5,250	7,350	8,193	11,196	8,340	7,607
McDonald	0	0	0	0	0	0	0
Newton	2,490	2,250	3,810	3,768	5,892	4,110	3,720
Ozark	0	0	0	0	0	0	0
Polk	1,740	1,200	1,350	2,964	4,248	4,350	2,642
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	76,140	43,770	55,830	70,770	98,154	79,470	70,689
Webster	0	0	0	648	639	870	360
Wright	0	0	0	0	0	0	0
Totals	209,790	142,140	207,690	261,750	298,779	266,460	231,102

YIELD (MMBTU/Year) - SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Total biomass production MMBTU						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	5,195	0	0	13,147	19,980	23,177	10,250
Barton	778,820	648,950	935,064	1,104,494	1,180,019	1,138,860	964,368
Cedar	59,940	35,964	42,358	57,143	0	75,924	45,221
Christian	0	0	0	0	0	0	0
Dade	300,899	207,792	280,919	429,570	463,536	366,833	341,591
Dallas	0	0	0	0	0	17,982	2,997
Douglas	0	0	0	0	0	0	0
Greene	5,195	0	0	0	0	20,380	4,262
Jasper	503,096	301,698	597,802	732,067	716,083	612,187	577,156
Lawrence	70,729	69,930	97,902	109,131	149,131	111,089	101,319
McDonald	0	0	0	0	0	0	0
Newton	33,167	29,970	50,749	50,190	78,481	54,745	49,550
Ozark	0	0	0	0	0	0	0
Polk	23,177	15,984	17,982	39,480	56,583	57,942	35,191
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	1,014,185	583,016	743,656	942,656	1,307,411	1,058,540	941,577
Webster	0	0	0	8,631	8,511	11,588	4,789
Wright	0	0	0	0	0	0	0
Totals	2,794,403	1,893,305	2,766,431	3,486,510	3,979,736	3,549,247	3,078,272

YIELD (Total Biomass MMBTU/Year @ 80% removal) – SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Available production MMBTU 80%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	4,156	0	0	10,517	15,984	18,541	8,200
Barton	623,056	519,160	748,051	883,596	944,015	911,088	771,494
Cedar	47,952	28,771	33,886	45,714	0	60,739	36,177
Christian	0	0	0	0	0	0	0
Dade	240,719	166,234	224,735	343,656	370,829	293,466	273,273
Dallas	0	0	0	0	0	14,386	2,398
Douglas	0	0	0	0	0	0	0
Greene	4,156	0	0	0	0	16,304	3,410
Jasper	402,477	241,358	478,241	585,654	572,867	489,750	461,724
Lawrence	56,583	55,944	78,322	87,305	119,305	88,871	81,055
McDonald	0	0	0	0	0	0	0
Newton	26,533	23,976	40,599	40,152	62,785	43,796	39,640
Ozark	0	0	0	0	0	0	0
Polk	18,541	12,787	14,386	31,584	45,267	46,354	28,153
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	811,348	466,413	594,924	754,125	1,045,929	846,832	753,262
Webster	0	0	0	6,905	6,809	9,271	3,831
Wright	0	0	0	0	0	0	0
Totals	2,235,522	1,514,644	2,213,145	2,789,208	3,183,789	2,839,398	2,462,618

YIELD (Total Biomass MMBTU/Year @ 50% removal) – SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Available production MMBTU 50%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	2,597	0	0	6,573	9,990	11,588	5,125
Barton	389,410	324,475	467,532	552,247	590,009	569,430	482,184
Cedar	29,970	17,982	21,179	28,571	0	37,962	22,611
Christian	0	0	0	0	0	0	0
Dade	150,449	103,896	140,459	214,785	231,768	183,416	170,796
Dallas	0	0	0	0	0	8,991	1,499
Douglas	0	0	0	0	0	0	0
Greene	2,597	0	0	0	0	10,190	2,131
Jasper	251,548	150,849	298,901	366,034	358,042	306,094	288,578
Lawrence	35,365	34,965	48,951	54,565	74,565	55,544	50,659
McDonald	0	0	0	0	0	0	0
Newton	16,583	14,985	25,375	25,095	39,241	27,373	24,775
Ozark	0	0	0	0	0	0	0
Polk	11,588	7,992	8,991	19,740	28,292	28,971	17,596
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	507,092	291,508	371,828	471,328	653,706	529,270	470,789
Webster	0	0	0	4,316	4,256	5,794	2,394
Wright	0	0	0	0	0	0	0
Totals	1,397,201	946,652	1,383,215	1,743,255	1,989,868	1,774,624	1,539,136

YIELD (Total Biomass MMBTU/Year @ 20% removal) – SOYBEAN

Soybean	**Based on USDA Data[10]**						
	Available production MMBTU 20%						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	1,039	0	0	2,629	3,996	4,635	2,050
Barton	155,764	129,790	187,013	220,899	236,004	227,772	192,874
Cedar	11,988	7,193	8,472	11,429	0	15,185	9,044
Christian	0	0	0	0	0	0	0
Dade	60,180	41,558	56,184	85,914	92,707	73,367	68,318
Dallas	0	0	0	0	0	3,596	599
Douglas	0	0	0	0	0	0	0
Greene	1,039	0	0	0	0	4,076	852
Jasper	100,619	60,340	119,560	146,413	143,217	122,437	115,431
Lawrence	14,146	13,986	19,580	21,826	29,826	22,218	20,264
McDonald	0	0	0	0	0	0	0
Newton	6,633	5,994	10,150	10,038	15,696	10,949	9,910
Ozark	0	0	0	0	0	0	0
Polk	4,635	3,197	3,596	7,896	11,317	11,588	7,038
Stone	0	0	0	0	0	0	0
Taney	0	0	0	0	0	0	0
Vernon	202,837	116,603	148,731	188,531	261,482	211,708	188,315
Webster	0	0	0	1,726	1,702	2,318	958
Wright	0	0	0	0	0	0	0
Totals	558,881	378,661	553,286	697,302	795,947	709,849	615,654

FESCUE DATA

Fescue did not have adequate data available to perform the data analyses and data table information as was available for the other crop residues. The following tables are projected and estimated data based on available information.

Farms/Year - FESCUE

Fescue	Projected DATA 2006-2010						
	Farms						
County	2005	2006	2007	2008	2009	2010	Mean
Barry	144	116	153	156	189	122	147
Barton	82	66	87	89	107	70	83
Cedar	74	60	79	80	97	63	75
Christian	58	47	62	63	76	49	59
Dade	88	71	94	95	115	75	90
Dallas	62	50	66	67	81	53	63
Douglas	29	23	31	31	38	25	30
Greene	78	63	83	84	102	66	79
Jasper	80	64	85	86	105	68	81
Lawrence	209	168	222	226	274	177	213
McDonald	24	19	26	26	31	20	24
Newton	109	88	116	118	143	93	111
Ozark	30	24	32	32	39	25	31
Polk	214	172	227	231	280	182	218
Stone	10	8	11	11	13	8	10
Taney	4	3	4	4	5	3	4
Vernon	91	73	97	98	119	77	93
Webster	42	34	45	45	55	36	43
Wright	58	47	62	63	76	49	59

Acres/Year – FESCUE

Fescue **Projected DATA 2006-2010**

	Acres						
County	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Mean**
Barry	12,545	10,091	13,331	13,553	16,441	10,648	12,768
Barton	4,505	3,624	4,787	4,867	5,904	3,824	4,585
Cedar	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Christian	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Dade	10,532	8,472	11,192	11,378	13,803	8,939	10,719
Dallas	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Douglas	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Greene	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Jasper	6,510	5,237	6,918	7,033	8,532	5,526	6,626
Lawrence	18,822	15,141	20,001	20,334	24,667	15,976	19,157
McDonald	2,314	1,861	2,459	2,500	3,033	1,964	2,355
Newton	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Ozark	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Polk	20,365	16,382	21,641	22,001	26,689	17,285	20,727
Stone	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Taney	350	282	372	378	459	297	356
Vernon	8,412	6,767	8,939	9,088	11,024	7,140	8,562
Webster	3,231	2,599	3,433	3,491	4,234	2,742	3,288
Wright	(D)	(D)	(D)	(D)	(D)	(D)	(D)

(D) Data withheld to avoid disclosing data for individual farms.

Pounds/Year – FESCUE

Fescue **Projected DATA 2006-2010**

	Pounds						
County	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Mean**
Barry	3,059,748	2,461,321	3,251,472	3,305,567	4,009,913	2,597,033	3,114,176
Barton	628,145	505,292	667,505	678,610	823,207	533,153	639,319
Cedar	1,076,705	866,123	1,144,171	1,163,207	1,411,062	913,879	1,095,858
Christian	759,276	610,777	806,852	820,276	995,059	644,453	772,782
Dade	2,051,267	1,650,079	2,179,799	2,216,065	2,688,261	1,741,061	2,087,756
Dallas	987,930	794,710	1,049,834	1,067,300	1,294,719	838,529	1,005,504
Douglas	422,135	339,574	448,586	456,049	553,224	358,297	429,644
Greene	924,938	744,038	982,895	999,247	1,212,165	785,063	941,391
Jasper	1,318,408	1,060,553	1,401,019	1,424,328	1,727,822	1,119,030	1,341,860
Lawrence	3,930,570	3,161,828	4,176,860	4,246,351	5,151,157	3,336,163	4,000,488
McDonald	516,498	415,481	548,862	557,993	676,890	438,390	525,686
Newton	2,287,667	1,840,244	2,431,012	2,471,457	2,998,072	1,941,711	2,328,361
Ozark	1,065,339	856,980	1,132,093	1,150,928	1,396,166	904,231	1,084,290
Polk	3,958,211	3,184,063	4,206,233	4,276,212	5,187,382	3,359,624	4,028,621
Stone	59,993	48,260	63,752	64,813	78,623	50,920	61,060
Taney	94,400	75,937	100,315	101,984	123,715	80,124	96,079
Vernon	1,765,565	1,420,255	1,876,195	1,907,410	2,313,838	1,498,565	1,796,971
Webster	825,438	663,999	877,160	891,753	1,081,767	700,610	840,121
Wright	1,184,418	952,769	1,258,634	1,279,574	1,552,224	1,005,303	1,205,487
Totals	26,916,651	21,652,282	28,603,249	29,079,125	35,275,265	22,846,139	27,395,452

Estimated Dry Pounds Dry Screenings/Year – FESCUE

Fescue	Projected DATA 2006-2010						
	Estimated lb of dry Screenings						
County	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Mean**
Barry	764,937	615,330	812,868	826,392	1,002,478	649,258	778,544
Barton	157,036	126,323	166,876	169,652	205,802	133,288	159,830
Cedar	269,176	216,531	286,043	290,802	352,765	228,470	273,964
Christian	189,819	152,694	201,713	205,069	248,765	161,113	193,196
Dade	512,817	412,520	544,950	554,016	672,065	435,265	521,939
Dallas	246,983	198,678	262,458	266,825	323,680	209,632	251,376
Douglas	105,534	84,893	112,146	114,012	138,306	89,574	107,411
Greene	231,235	186,010	245,724	249,812	303,041	196,266	235,348
Jasper	329,602	265,138	350,255	356,082	431,956	279,757	335,465
Lawrence	982,643	790,457	1,044,215	1,061,588	1,287,789	834,041	1,000,122
McDonald	129,125	103,870	137,215	139,498	169,222	109,597	131,421
Newton	571,917	460,061	607,753	617,864	749,518	485,428	582,090
Ozark	266,335	214,245	283,023	287,732	349,042	226,058	271,072
Polk	989,553	796,016	1,051,558	1,069,053	1,296,845	839,906	1,007,155
Stone	14,998	12,065	15,938	16,203	19,656	12,730	15,265
Taney	23,600	18,984	25,079	25,496	30,929	20,031	24,020
Vernon	441,391	355,064	469,049	476,852	578,460	374,641	449,243
Webster	206,360	166,000	219,290	222,938	270,442	175,152	210,030
Wright	296,105	238,192	314,658	319,893	388,056	251,326	301,372
Totals	6,729,163	5,413,071	7,150,812	7,269,781	8,818,816	5,711,535	6,848,863

MMBTU/Year – FESCUE

Fescue **Projected DATA 2006-2010**

	MMBTU						
County	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Mean**
Barry	6,119	4,923	6,503	6,611	8,020	5,194	6,228
Barton	1,256	1,011	1,335	1,357	1,646	1,066	1,279
Cedar	2,153	1,732	2,288	2,326	2,822	1,828	2,192
Christian	1,519	1,222	1,614	1,641	1,990	1,289	1,546
Dade	4,103	3,300	4,360	4,432	5,377	3,482	4,176
Dallas	1,976	1,589	2,100	2,135	2,589	1,677	2,011
Douglas	844	679	897	912	1,106	717	859
Greene	1,850	1,488	1,966	1,998	2,424	1,570	1,883
Jasper	2,637	2,121	2,802	2,849	3,456	2,238	2,684
Lawrence	7,861	6,324	8,354	8,493	10,302	6,672	8,001
McDonald	1,033	831	1,098	1,116	1,354	877	1,051
Newton	4,575	3,680	4,862	4,943	5,996	3,883	4,657
Ozark	2,131	1,714	2,264	2,302	2,792	1,808	2,169
Polk	7,916	6,368	8,412	8,552	10,375	6,719	8,057
Stone	120	97	128	130	157	102	122
Taney	189	152	201	204	247	160	192
Vernon	3,531	2,841	3,752	3,815	4,628	2,997	3,594
Webster	1,651	1,328	1,754	1,784	2,164	1,401	1,680
Wright	2,369	1,906	2,517	2,559	3,104	2,011	2,411
Totals	53,833	43,305	57,206	58,158	70,551	45,692	54,791

PERSONNEL:

Sunesis Personnel:

Barnabas Reynolds, General Manager

Gideon Reynolds, Project Technician

Alexander Reynolds, Project Technician

BCS:

Tom Crawford, President

James Story, Consultant

BioChoice:

Roger Schnake, Managing Director

Bill Harvill, Associate

HISTORY AND QUALIFICATIONS

SUNESIS – Established in Missouri on February 25, 1998, Sunesis has provided technical assistance throughout the years to several companies, including:

Intermarine USA, Savannah, Georgia (1998-2000) – (company is now out-of –business) – provided assistance in contract administration, project administration, contract claims, manufacturing and production technology assistance, research and development (NSRP), engineering support and analysis, expert witness testimony, contract negotiations, and other assistance.

US Navy – NAVSEA (1998-2002) provided pro-bono consulting services on intermittent basis regarding contact issues, project administration, and contract negotiations.

D. Sweeney and Associates, Savannah, Georgia (1998-2002) – Provided consulting assistance in contract administration, project administration, contract claims, expert witness testimony, contract negotiations, and other technical assistance.

Tra-Lor-Mate, Salem, Missouri (2001-present) – provided technical and consulting services for new products, resolving manufacturing issues, providing engineering support, grant and solicitation notifications, proposal assistance, and assistance in other areas.

Def-Bar, Salem & Lebanon, Missouri (2004-present) - provided technical and consulting services for new products, resolving manufacturing issues, providing engineering support, grant and solicitation notifications, proposal assistance, and technical assistance in other areas.

Misc clients (1998-present) – Assistance in federal procurements, computer analysis, data analysis, research and development, manufacturing issues, engineering support, contract issues, and other areas.

All Sunesis employees have computer experience, agricultural experience and have lived/worked on family farms since 1997, raising horses, cattle, goats, and sheep.

Contact person: Barnabas Reynolds, General Manager
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BioChoice Energy Group

BioChoice Energy Group (BCEG), a consortium of farmers and businessmen located in southwest Missouri, is in the process of establishing a new biomass fuel processing enterprise in southwest Missouri which will serve the region's poultry growers, as well as other potential rural energy consumers. The enterprise also plans to assist growers with surplus poultry litter management in which the litter will be used to produce feedstocks for biomass furnace systems.

Contact person: Roger Schnake, Managing Director
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Business Consulting Services (BCS)

BCS is a group of consultants that provide consulting and research for agricultural based businesses and other businesses in areas of value added agriculture, agriculture energy projects, and other agricultural related projects. They also provide business consulting services to other businesses.

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