National Sorghum Producers (John Duff)

National Sorghum Producers (NSP) is extremely grateful for the work done by the State of New Mexico on this important standard. The process has been difficult; however, the state has managed the diverse opinions and interests of its stakeholders well, and this perseverance has resulted in a good program that will not only drive positive environmental outcomes but create business opportunities for renewable fuel producers and farmers, as well. NSP applauds the calculators and their methodologies, and in particular, the user-friendliness of the Tier 1 calculators. We also appreciate the thoughtful approach to calculating the emissions factors of the individual greenhouse gas species, and we support the state's willingness to modify certain parameters of GREET as needed. In that spirit, our only recommendation is to modify Inputs!N345, Inputs!N347:N349, Inputs!N352:N353, EtOH!FY476:FY478 and EtOH!FY482 (or there precedents as appropriate) based on the updated information attached. We have previously supplied this information to the state, and we are currently working with a land grant university partner and national laboratory to publish this and other information supporting a modification. Thank you again for the hard work on the policy to this point and the willingness to consider futures changes to strengthen it. If you have questions on this comment of the information supplied, please do not hesitate to contact us.

SORGHUM CROP INPUT CONSIDERATIONS FOR NM-GREET
Prepared by National Sorghum Producers

March 18, 2025

Background

Current sorghum default inputs in the draft version of NM-GREET are based on the default inputs from R&D GREET. While R&D GREET is unquestionably the gold standard in greenhouse gas modeling in transportation fuels, the sorghum inputs are based on the USDA Agricultural Resource Management Survey (ARMS), which has both spatial and temporal challenges related to sorghum. For example, since 1990, ARMS has surveyed corn 20 times, compared to just six for sorghum, and four of these six years saw significant drought, overstating the inputs relative to production. Furthermore, there are only two states which were surveyed in each of these six years, and these did not include Texas, which is the second-largest sorghum-producing state. Thus, both spatial and temporal challenges render the sorghum data untrustworthy.

To address this concern, over the past 15 years, NSP has collected a large amount of sorghum crop input data. The sources for these data are highly varied and include statistically significant surveys of sorghum farmers, biodiversity programs with wildlife-focused nongovernmental organizations (NGOs), lifecycle analyses conducted at land grant universities as well as extension hybrid trials. The sections below summarize this information and provide it in reference form for future citations as all this information is publicly available. Figure 1 includes an overview of the data sources and Figure 2 includes a data summary which can be used to populate NM-GREET directly. Given the scope of this information and representativeness both spatially and temporally, we believe it is extremely important for these inputs to be reflected in the final version of NM-GREET.

Figure 1. Data Sources Including Crop Inputs for Sorghum.

Data Source	Abbreviation	Years Covered	Relevance
SGS North America[1]	SGS	2008-2011	Statistically significant third-party survey of sorghum farmers
Strategic Marketing Research & Planning (first survey)[2]	SMRP1	2017-2019	Statistically significant third-party survey of sorghum farmers
Strategic Marketing Research & Planning (second survey)[3]	SMRP2	2019-2021	Statistically significant third-party survey of sorghum farmers

[1] https://www.sorghumcheckoff.com/wp-content/uploads/2022/08/The-Carbon-Footprint-of-Sorghum-1.pdf
[2] https://www.sorghumcheckoff.com/wp-content/uploads/2022/08/2020-Carbon-Footprint-Study-1.pdf
[3] https://www.sorghumcheckoff.com/wp-content/uploads/2022/08/2022-Carbon-Footprint-Study-1.pdf

Strategic Marketing Research & Planning (third survey)[4]	SMRP3	2021-2023	Statistically significant third-party survey of sorghum farmers
Sustainable Environmental Consultants[5]	SEC	2020-2022	Data for biodiversity program with key wildlife NGO
Kansas State University[6]	KSU	2011	Third-party lifecycle analysis
Land Grant University Extension Hybrid Trials[7]	Trials	2008-2022	Fifteen years of scientific trials at seven universities across 31 locations and 5,181 observations

Figure 2. Summary of Data Sources Including Crop Inputs for Sorghum.

Assumption	Unit	SGS	SMRP1	SMRP2	SMRP3	SEC	KSU*	Trials**	Average
Diesel	btu/bu	6,943.52	4,402.79	3,520.59	5,159.58	5,500.35	4,287.30	-	4,969.02
Gasoline	btu/bu	497.36	-	-	-	-	-	-	497.36
Natural Gas	btu/bu	0.00	-	-	-	-	-	-	0.00
Electricity	btu/bu	39.11	-	-	-	-	-	-	39.11
Nitrogen	g/bu	411.93	405.62	416.56	413.82	392.04	423.35	394.13	408.21
Phosphorus	g/bu	99.24	119.37	115.05	208.33	-	175.07	83.67	133.45
Potassium	g/bu	20.24	18.09	10.12	-	-	0.00	0.36	9.76
Herbicide	g/bu	27.23	-	-	-	-	7.77	-	17.50

*Given this study was an LCA, it was assumed that it covered the equivalent of one acre.
**Given these were land grant university hybrid trials, it was assumed that each observation covered the equivalent of one acre.

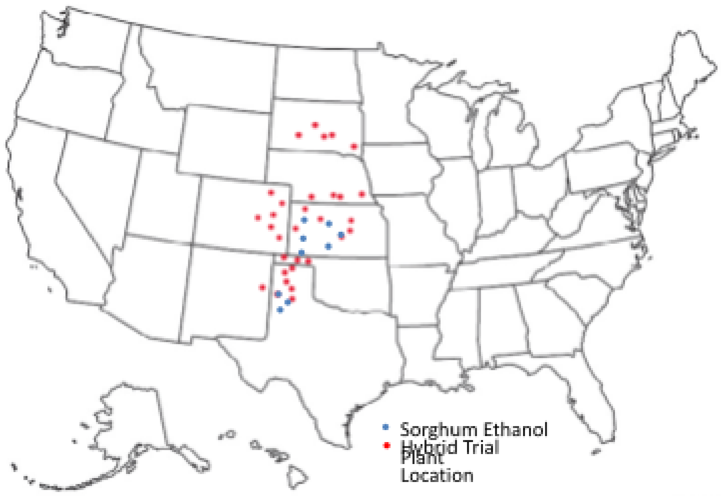
Base Assumptions

The total area covered by the seven data sources was 173,384.28 acres. Note, however, that KSU and Trials were much lower. KSU was a lifecycle analysis, so it was assumed that it covered the equivalent of one acre. Similarly, Trials included 15 years of scientific hybrid trials at seven universities across 31 locations and 5,181 observations, so it was assumed that each observation covered the equivalent of one acre. With both KSU and Trials, this is a reasonable assumption as these values will scale. Figure 3 includes a map of the 31 locations represented in Trials overlaid with sorghum ethanol plants for reference. Each of the six other data sources were also based on production within the confines of this

[4] https://www.sorghumcheckoff.com//2024/01/SMRPwp-content/uploads3.pdf
[5] https://www.sorghumcheckoff.com/wp-content/uploads/2022/10/EP-ALL-Supply-Chain-Report_2020_V3.pdf
https://www.sorghumcheckoff.com/wp-content/uploads/2023/09/EP-Sorghum-Checkoff-Executive-Summary_2021-V2.pdf
https://www.sorghumcheckoff.com/wp-content/uploads/2023/09/EP-Sorghum-Checkoff-Executive-Summary_2022-V2.pdf
[6] https://www.sorghumcheckoff.com/wp-content/uploads/2023/10/nelson_diesel_work_ksu.pdf
[7] https://csucrops.com/sorghum/
https://krex.k-state.edu/handle/2097/16531
https://cropwatch.unl.edu/varietytest/sorghum
https://clovissc.nmsu.edu/research/trails.html
https://extension.okstate.edu/search-results.html?q=Grain+Sorghum+Performance+Trials
https://extension.sdstate.edu/sorghum-trial-results
https://ccag.tamu.edu/extension/soil-crop-sciences/grain-sorghum-hybrid-trial-results/

region, which includes more than 85 percent of U.S. sorghum area and produces 100 percent of U.S. sorghum ethanol.

Figure 3. Trials and Sorghum Ethanol Plant Locations.



Energy Inputs

Average diesel usage in British thermal units per bushel across the seven data sources was 4,969.02. In SGS, SMRP1, SMRP2, SMRP3 and SEC, diesel usage was calculated using fuel consumption data from Virginia Cooperative Extension[8] per this equation:

$$D = [\sum (N_{share} * N_{diesel} + R_{share} * R_{diesel} + C_{share} * C_{diesel} + R + P + S + H)] / n$$

Where D is average diesel usage in British thermal units per bushel, N_{share} is the percentage of acres in no-till systems, N_{diesel} is the amount of diesel used in no-till systems, R_{share} is the percentage of acre in reduced till systems, R_{diesel} is the amount of diesel used in reduced till systems, C_{share} is the percentage of acres in conventional till systems, C_{diesel} is the amount of diesel used conven tional till systems, R is the amount of residual diesel used, P is the amount of diesel used for planting, S is the amount of diesel used for spraying and H is the amount of diesel used for harvesting. Diesel usage was given in KSU, and residual diesel, gasoline, natural gas and electricity usage were given in SGS. For each fuel type, energy usage associated with field activities, trucking and storage are included in the combined value.

Fertilizer Inputs

Average nitrogen, phosphorus and potassium applications in grams per bushel were 408.21, 133.45 and 9.76, respectively. If applicable, these values were given in all seven data sources.

Herbicide Inputs

Average herbicide usage across the seven data sources was 17.50 grams of active ingredient per bushel. Pesticide usage was given in SGS in gallons per acre. To convert to grams of active ingredient, a weighted average active ingredient factor was calculated based on the pesticide program assumed by the R&D

[8] https://vtechworks.lib.vt.edu/bitstream/handle/10919/47472/442-073_pdf.pdf

GREET. This program includes atrazine,[9] metalochlor,[10] acetochlor[11] and cyanazine.[12] This is a realistic program and results in a calculated pesticide usage value for SGS near that of R&D GREET. Pesticide usage in active ingredient volume was given in KSU.

[9] https://www.syngenta-us.com/current-label/aatrex_4l
[10] https://www.syngenta-us.com/current-label/dual_magnum
[11] https://cs-assets.bayer.com/is/content/bayer/Warrant_Herbicide_Bayer1p_Labelpdf
[12] https://www3.epa.gov/pesticides/chem_search/ppls/000352-00470-19990115.pdf