Why On-Farm Evaluations Are Critical: Establishing demonstrations to asses alternative ingredients and raw materials

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Why demonstrations are important

- Change is hard

- Safety of what we know vs risk of what we don’t know (the change)

How to reduce decision risk?

- Demonstrations that provide objective facts, data, and local experience reduce decision risk and enhance the possibility of successful outcomes

- Effective communication tool

- Seeing is believing!

Organizational culture

- Organizations have unique cultures or personalities just like people: reward for risk taking vs punishment for failure?
- The challenge is to effectively communicate new ideas/ opportunities.
- Important to understand the culture to craft an effective communication strategy.

As nutritionists what is your role in helping organizations learn and change?

- Teacher ?
- Influencer ?
- Technical expert ?
- Change agent ?
- All the above ?

How to be an effective communicator of opportunities for improvement is not the same as knowing how to balance a ration using a new or alternative ingredient. Both skill sets are important but they are different.

Important to state the goal: Defining the why

- Communicate the purpose to the organization
- Prevent “redefining “ the project by others
- Examples:
  - Lower cost of gain vs use of alternatives
  - Lower cost of gain vs increased complexity
  - Lower cost of gain vs new for the sake of new

Goal of the Demonstration

- Evaluation of grain sorghum as an alternative cereal grain to reduce feed cost per unit of gain in Smithfield Hog Production east Coast Operations.
    - Impacts on animal performance?
    - Over coming internal resistance related to milling and handling requirements for maximum feeding value

Project design: "Begin with the end in mind."
-Stephen Covey

- Key Considerations:
  - Who is the audience? Who in the organization is most affected by change (procurement, storage, milling, etc)?
  - What, where, and who are the barriers to acceptance?
  - What are the variables that are important to control (particle size, moisture, accurate nutrient profile).

Principals of project development

- Define a focused objective of each trial or demonstration (don't try to answer too many questions with one trail or demo).
- Sample size calculations (statistical power test)?
- Determine appropriate design(s);
    - Variables of interest / proper controls
    - Accurate data collection
    - How to control variation
- Important questions are rarely answered with one trial. Several trails may be required to provide full understanding.
- Accuracy of reference nutrient content data for alternatives? Consider the source. When last updated?

The effects of sorghum inclusion in grow-finish diets on F/G and ADG in swine

- Justification: Corn price differential between Midwest and East Coast operations had risen to new highs threatening the long term economic viability. Sorghum was identified as viable alternative cereal grain for local procurement at favorable pricing to rail delivered corn

- Treatments: Control, control with sorghum to replace 50% of corn, or control with sorghum to replace 75% of corn

- Data Analysis: ADG calculated using pig days; pen averages used as the experimental unit with 14 pens/trt; ADG and sale weight were analyzed with place wy as covariate.

RESULTS		Treatments				Trt
Growth Performance		Control	50% Sorghum	75% Sorghum	SE	(P<)
	Start Weight, lb	59.8	58.8	62.4	1.26	0.120
	Observations, n	14	14	14		
Trial Duration (3/30/12 - 08/15/12)						
	ADG, 0-22wks, lb/d	1.85	1.85	1.87	0.016	0.796
	F:G, 0-22 wks, lb feed/lb gain	2.66	2.66	2.73	0.036	0.279
	% Mortality	2.3	4.9	2.7	0.010	0.120
	% Culls	4.5	1.5	3.8	0.012	0.207
	Sale Weight, lb	309.6	309.8	307.8	2.013	0.749

Concl usion

- Pigs fed all levels of sorghum had similar average daily gain, feed conversion, stayability, mortality and end weights as pigs fed the control.
- With the 75% inclusion of sorghum pigs had numerically higher feed conversion; however, the difference was not statistically different.

Understand Nutrient Variability

	Competition	Launch
Starch (% DM)	67.13	70.72
Protein (% DM)	10.19	9.93
Fat (% DM)	2.28	2.65
ADF (% DM)	5.11	5.27
NDF (% DM)	8.90	7.51
Ash (% DM)	1.59	1.57

KCal (KCal/lb)	1843.91	1858.515
Kcal per bushel	99571.14	107793.87
Kcal per acre	8861831.46	10887180.87

TW/Yield: competition average 54lb/89bu vs CSS average 58lb/101bu. Data from multiple environments spanning SC, NC and GA

- Increased yield and improved quality
- High-test weights drive available calories
  - Kcal per acre target of continuous improvement

20% difference

(per acre basis – increasing available calories per unit area)

Milling and Storing : a case study

-Compare sorghum grinding speed and cost to corn (increased throughput, reduced cost)

-Storage cost? On a volumetric basis, sorghum can store more calories per area in bins (increase grain bin utilization without additional CapEx)

-Sorghum can also be mixed in the bin with corn to maximize flexibility and extend harvest purchasing window (procuring feed at seasonally cheaper prices)

Impact of screen size on particle size

Treatment

Screen size	Corn* (N)	Sorghum* (N)	SE	P-value
4 x 4	345.0 (2)	388.3 (3)	7.94	0.03
4 x 5	355.3 (3)	410.0 (2)	4.79	0.00
5 x 5	347.0 (2)	424.7 (3)	10.19	0.01
5 x 6	376.0 (2)	471.0 (2)	2.92	0.00
6 x 6	427.0 (2)	500.5 (2)	15.54	0.08

*microns

Throughput/hr and cost/ton

Grain	Screen size	Throughput ton per machine per hr	Theoretical cost per ton (electrical)
sorghum	4 x 4	30.68	$0.35
sorghum	4 x 5	33.02	$0.33
sorghum	5 x 5	37.09	$0.29
sorghum	5 x 6	37.55	$0.29
sorghum	6 x 6	48.97	$0.22
corn	4 x 4	17.00	$0.54
corn	4 x 5	24.00	$0.39
corn	5 x 5	23.75	$0.39
corn	5 x 6	21.78	$0.43
corn	6 x 6	36.89	$0.25

Corn analysis

Screen Size	Particle Size	Change in Particle Size	Incremental Value Change[a]	Cummulative Value Change	Cost to grind/ton
4 x 4	345.0	0	$0.00	$3.48	$0.54
4 x 5	355.3	0	$0.00	$3.48	$0.39
5 x 5	347.0	(29.0)	$1.26	$3.48	$0.39
5 x 6	376.0	(51.0)	$2.22	$2.22	$0.43

[A] Incremental value of a change in particle size is: $.0435/ton for a 1 micron change for corn. N.B. Particle sizes are in microns.

Sorghum analysis

Screen Size	Particle Size	Change in Particle Size	Incremental Value Change [A]	Cummulative Value Change	Cost to grind/ton
4 x 4	388.3	(21.7)	$0.94	$4.88	$0.35
4 x 5	410.0	(14.7)	$0.64	$3.93	$0.33
5 x 5	424.7	(46.3)	$2.02	$3.30	$0.29
5 x 6	471.0	(29.5)	$1.28	$1.28	$0.29

[A] Incremental value of a change in particle size is: $.0435/ton for a 1 micron change for corn. Proper grinding of sorghum is essential for optimal nutrient utilization.

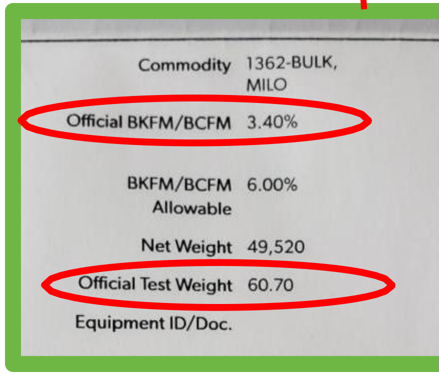
Storage considerations

-Standard corn test weight: 56-58 lbs per bushel

-CSS sorghum test weight: 58-60 lbs per bushel

100k bushel storage bin can hold ~400k more pounds of CSS milo than standard corn

Weight ticket from MD grower.



Commodity	1362-BULK, MILO
Official BKFM/BCFM	3.40%
BKFM/BCFM Allowable	6.00%
Net Weight	49,520
Official Test Weight	60.70
Equipment ID/Doc.	

Grinding & Storage Conclusions

- In order to achieve <400 micron for sorghum, use a 4x4 screen.
- Sorghum cost benefit is optimized on a 4x4 screen.
- No changes were seen in corn particle size reduction between screen sizes 5x5, 5x4, and 4x4.
- Corn cost benefit is optimized on a 5x5 screen.
- Cost to grind corn ($0.39/ton) and sorghum ($0.35/ton) are similar, but sorghum is cheaper.
- Additional studies are required to further investigate the cost/benefit of using screen sizes smaller than 5x5 for corn.

Change is not easy !

- Winston Churchill :
  - “Take change by the hand or it will take you by the throat.”
  - “To improve is to change; to be perfect is to change often.”
- Demonstrations are an effective tool to help organizations objectively evaluate alternative ingredients and support a culture of continuous improvement.

The only constant is change

Other ingredient choice issues to consider?

- Nutritional decisions to improve animal (and human) health
- Preference for non-GMO ingredients and ‘clean labels’
- Sustainability
- Regenerative agriculture
- Climate change resilience

Ingredients to promote health

ELSEVIER

Food Bioscie

Volume 59, June 2024

Impact of sorghum (*Sorgh*
Moench) phenolic compo
development pathways

Aduba Collins [a c], Abishek Bommannan Santhakumar [a]
Christopher Blanchard [a b c], Kenneth Chinkwo [a c]

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Journal of Chemistry

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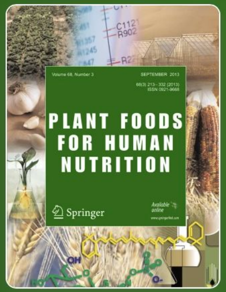
Sorghum [*Sorghum bicolor* (L.) Moench] Genotypes with Contrasting Polyphenol Compositions Differentially Modulate Inflammatory Cytokines in Mouse Macrophages

Home > Plant Foods for Human Nutrition > Article

Gastrointestinal Health Benefits of Sorghum Phenolics

Review | Published: 30 August 2024

(2024) Cite this article



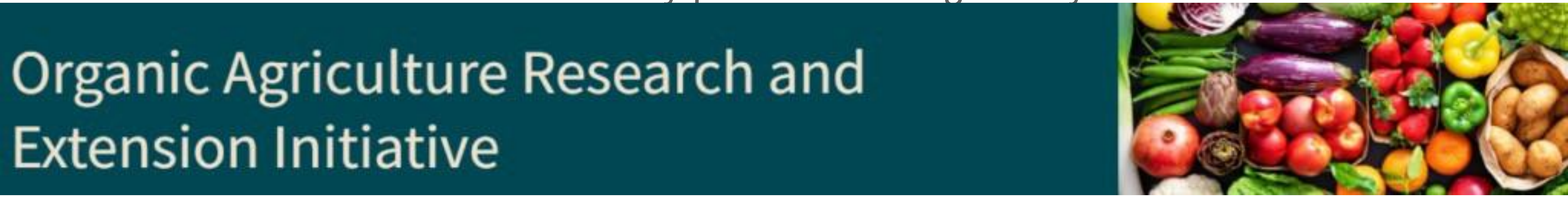
Plant Foods for Human Nutri

Aims and scope →

Submit manuscript →

Non-GMO and organic sorghum

All US sorghum is tannin free and non-GMO, but sorghum can be economically produced in organic systems



CSS sorghum was overall winner with over 80 bushels per acre in the trial fund by USDA Organic Agriculture Research and Extension Initiative

Blackville, SC 2022 – CSS hybrid on right. Since this was organic, there was no insecticide or fungicide applied

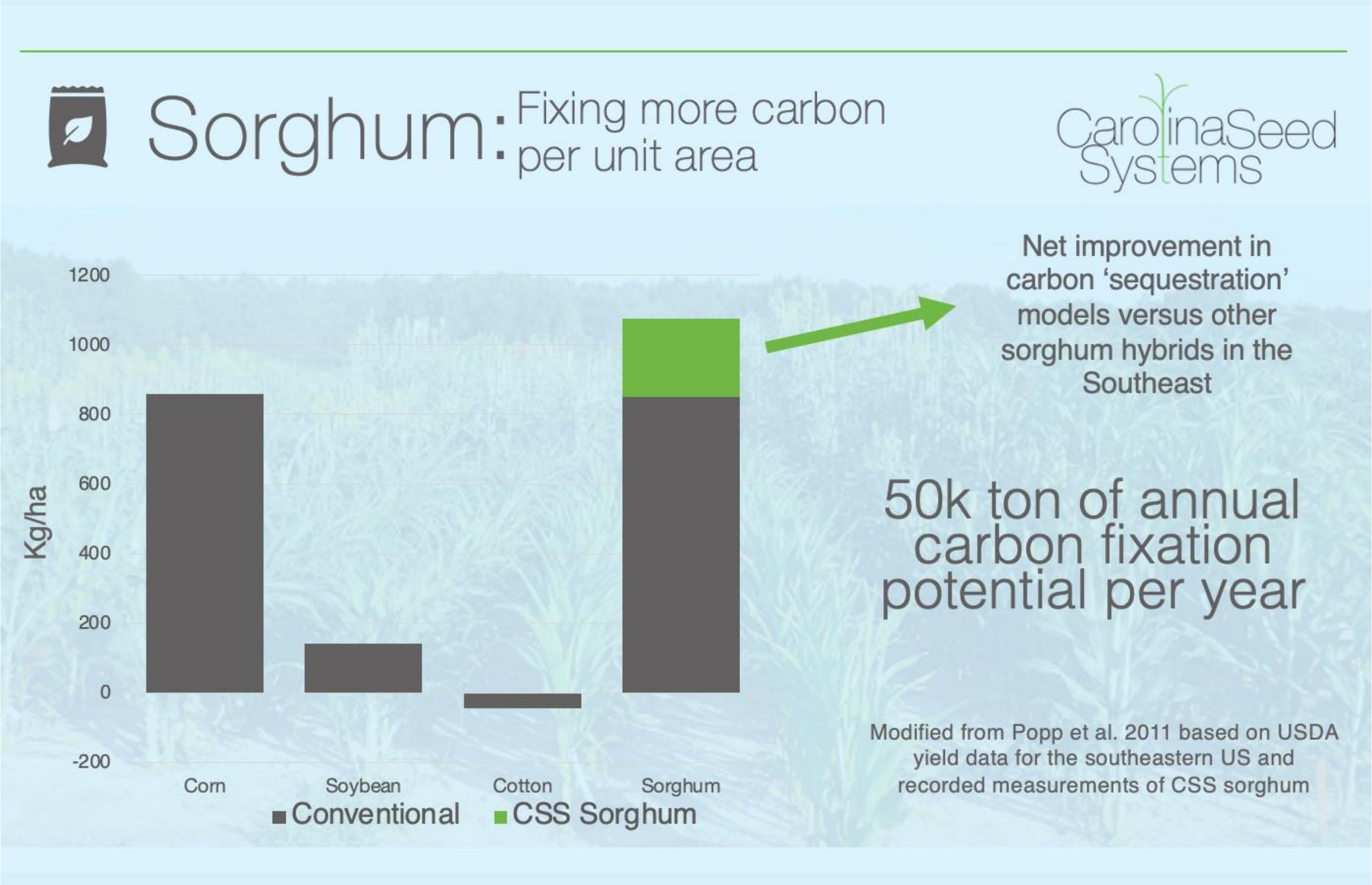
The sustainable feed grain

Lowering the carbon intensity of food, feed, and fuel

Genomics for sub-optimal conditions

Acidic, heavy clay across Appalachian

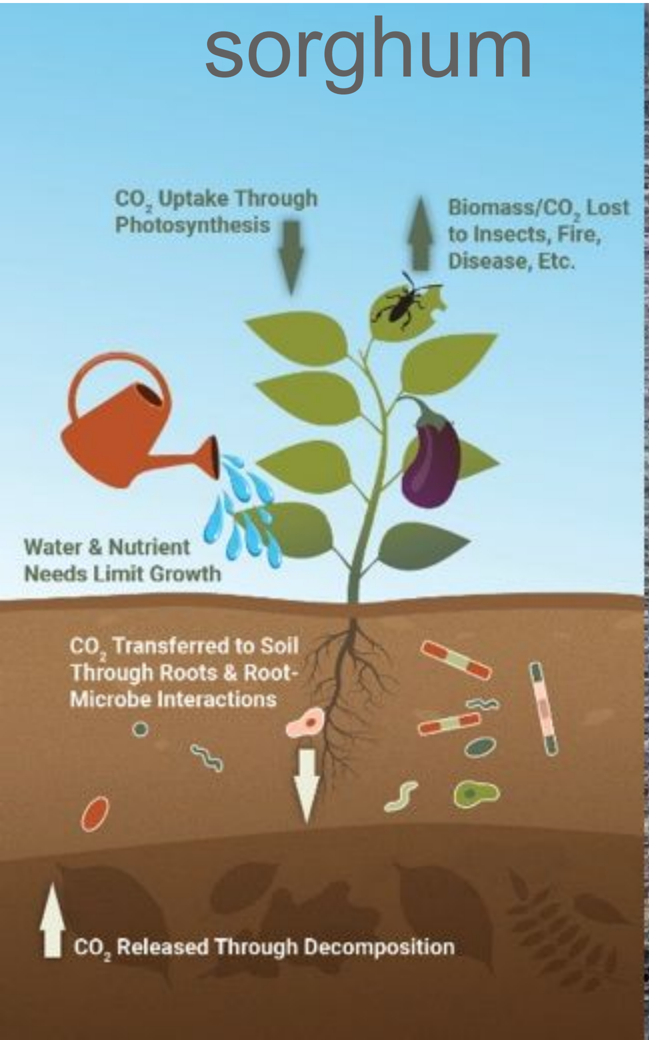
Sandy loam, low organic matter in coastal plain



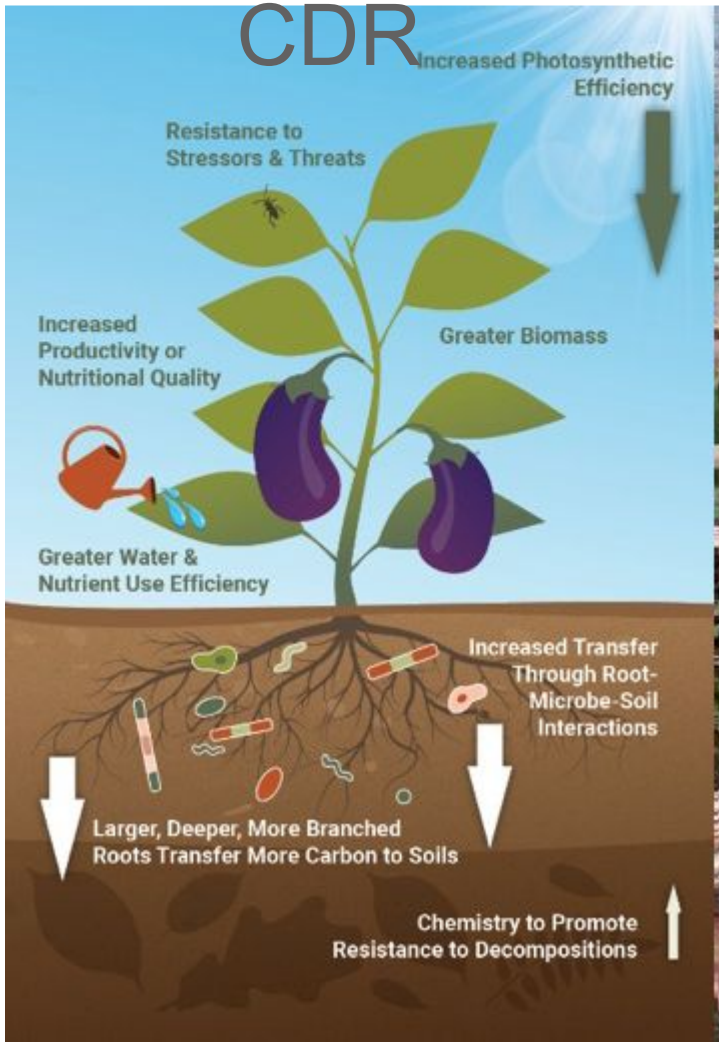
Improved yield and reduced GHG on non-premium land

Sorghum for carbon dioxide removal (CDR)

Standard sorghum



CSS sorghum for CDR



Thank You

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