Experiences of using DDGS in México

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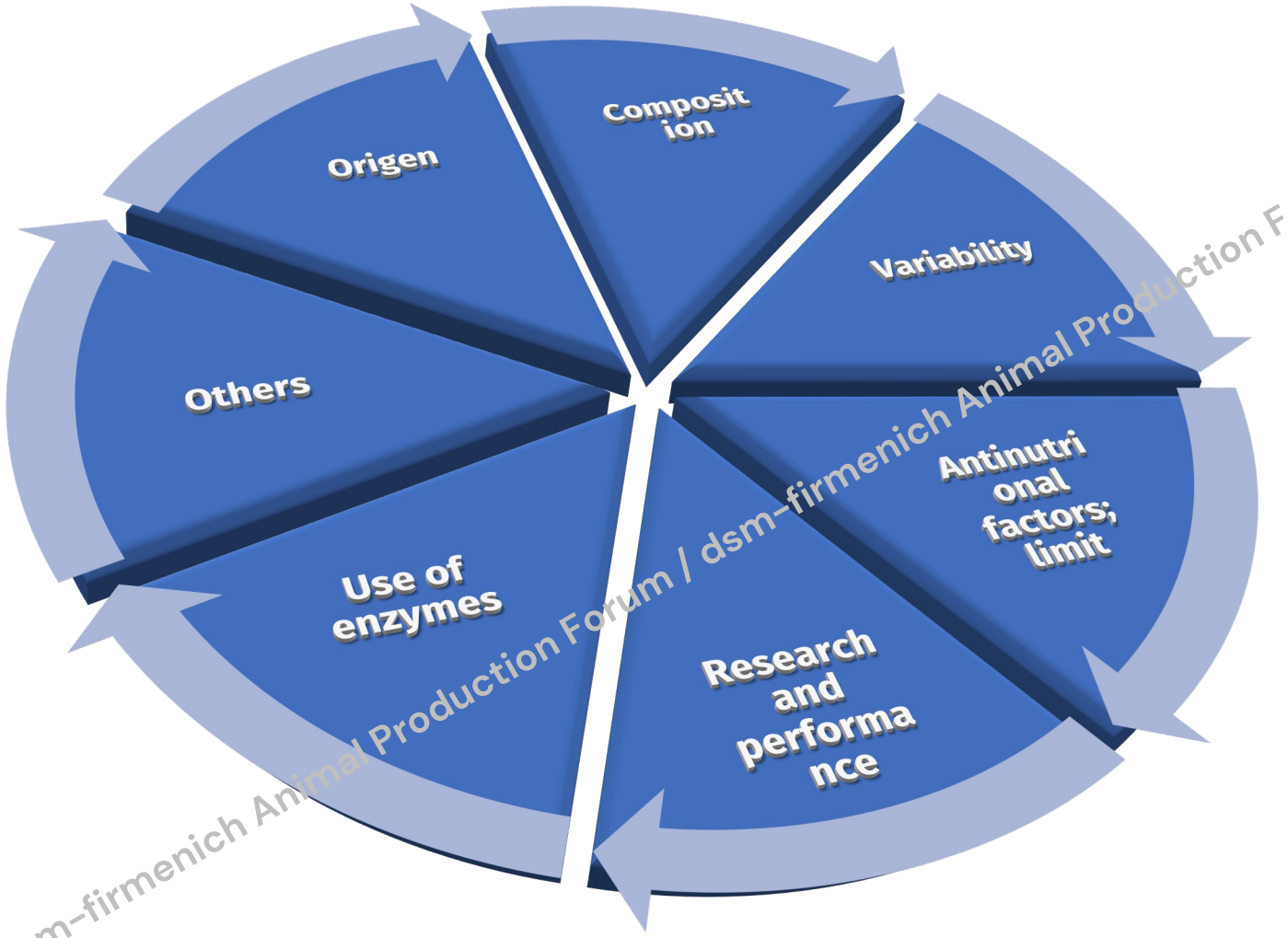
Alternative ingredient

Distillers Dried Grains with Solubles (DDGS)

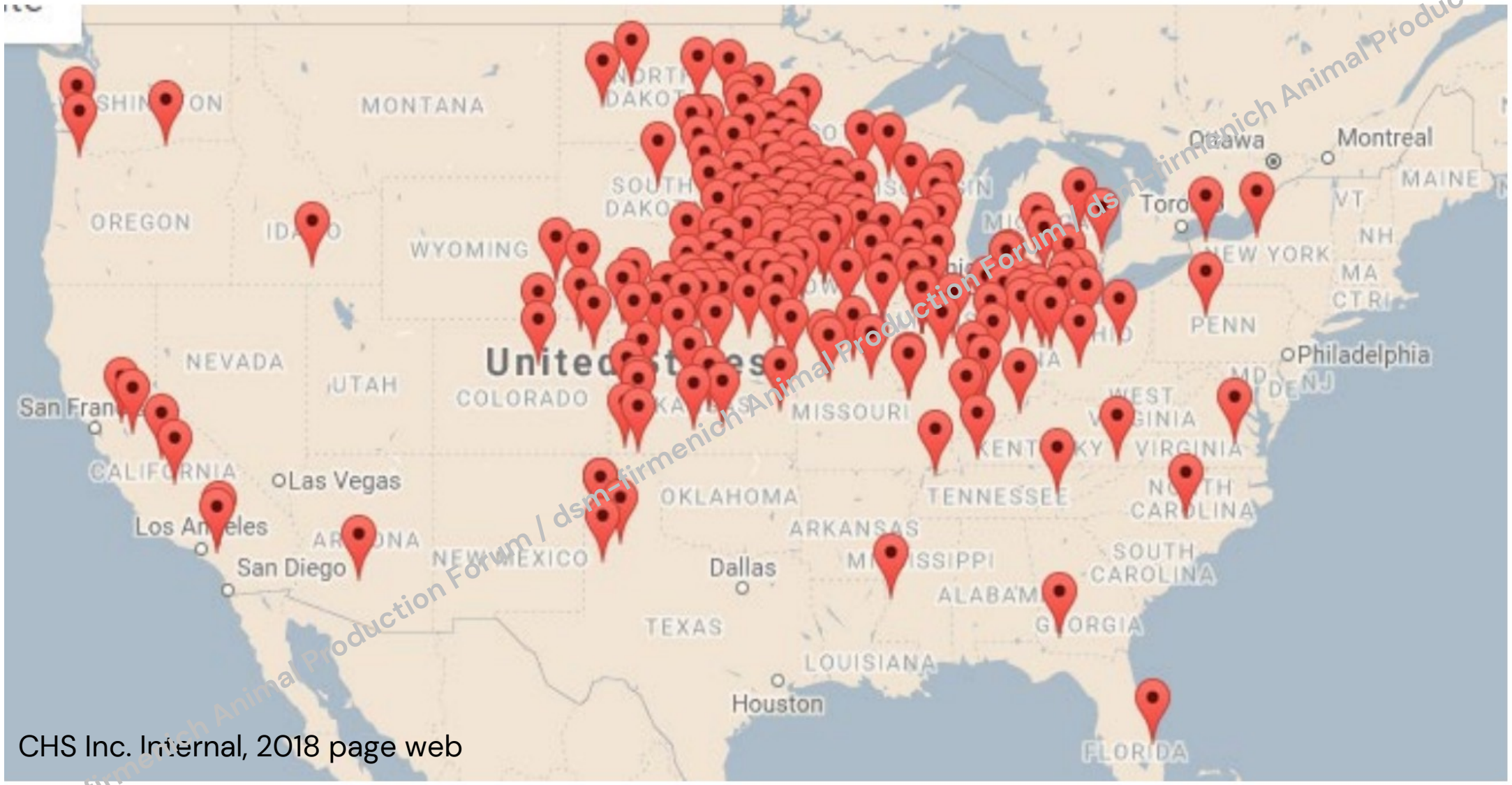
Granos Secos de Destilería con Solubles

- They are byproducts of production bioethanol.
- Result of the starch fermentation process.
- Mainly yellow corn.
- Some nutrients are concentrated up to 3 times more than in the original grain.

What should I know?

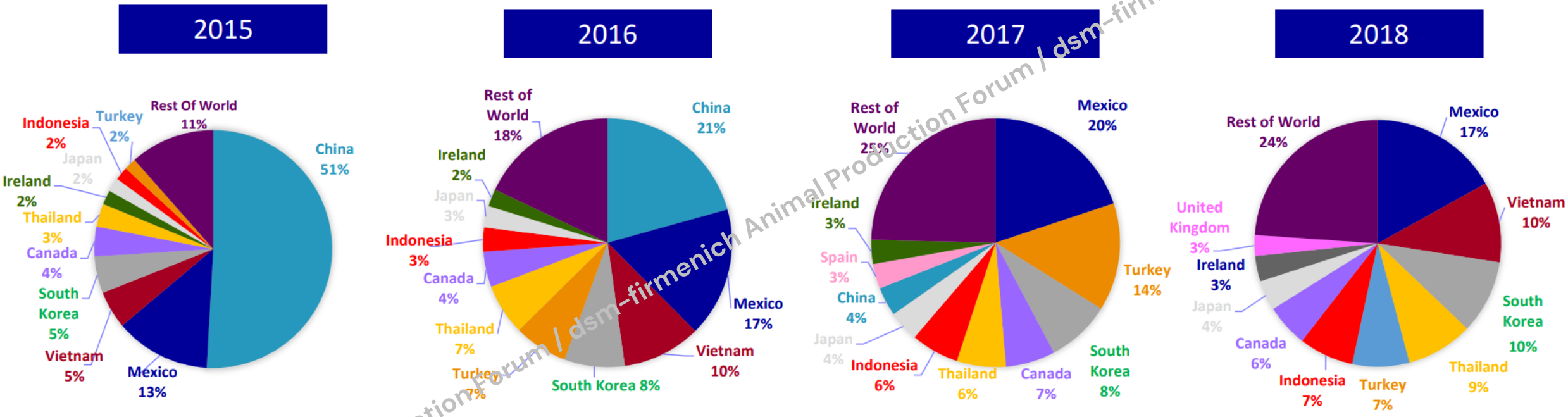


Ethanol plants locations



CHS Inc. Internal, 2018 page web

DDGS Export comparison



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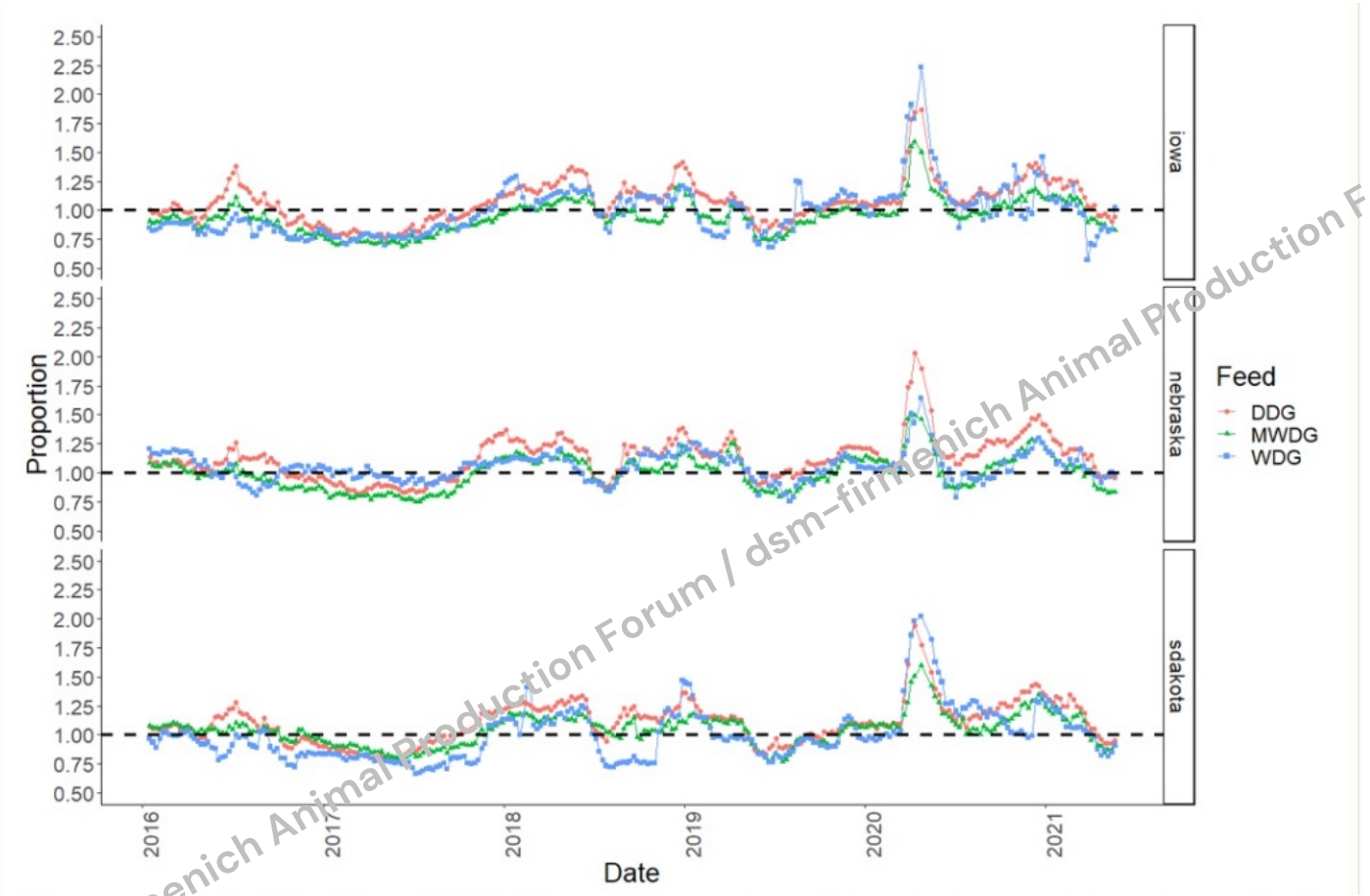
Historical price

Soybean meal

Corn

DDG, MDGS and WDGS as a proportion of corn Price on a Dry Matter Basis for Nebraska, Iowa and South Dakota, 16-21



https://beef.unl.edu/beefwatch/2021/impact-higher-grain-prices-feedlot%E2%80%99s-decision-feed-distillers-grains

.....Comments over DDGS

DDGS prices fall as demand for ethanol increased due to rising fuel prices. Situation on the Mississippi River continues.
DDGS's price competitiveness is due to rising soybean paste and corn.

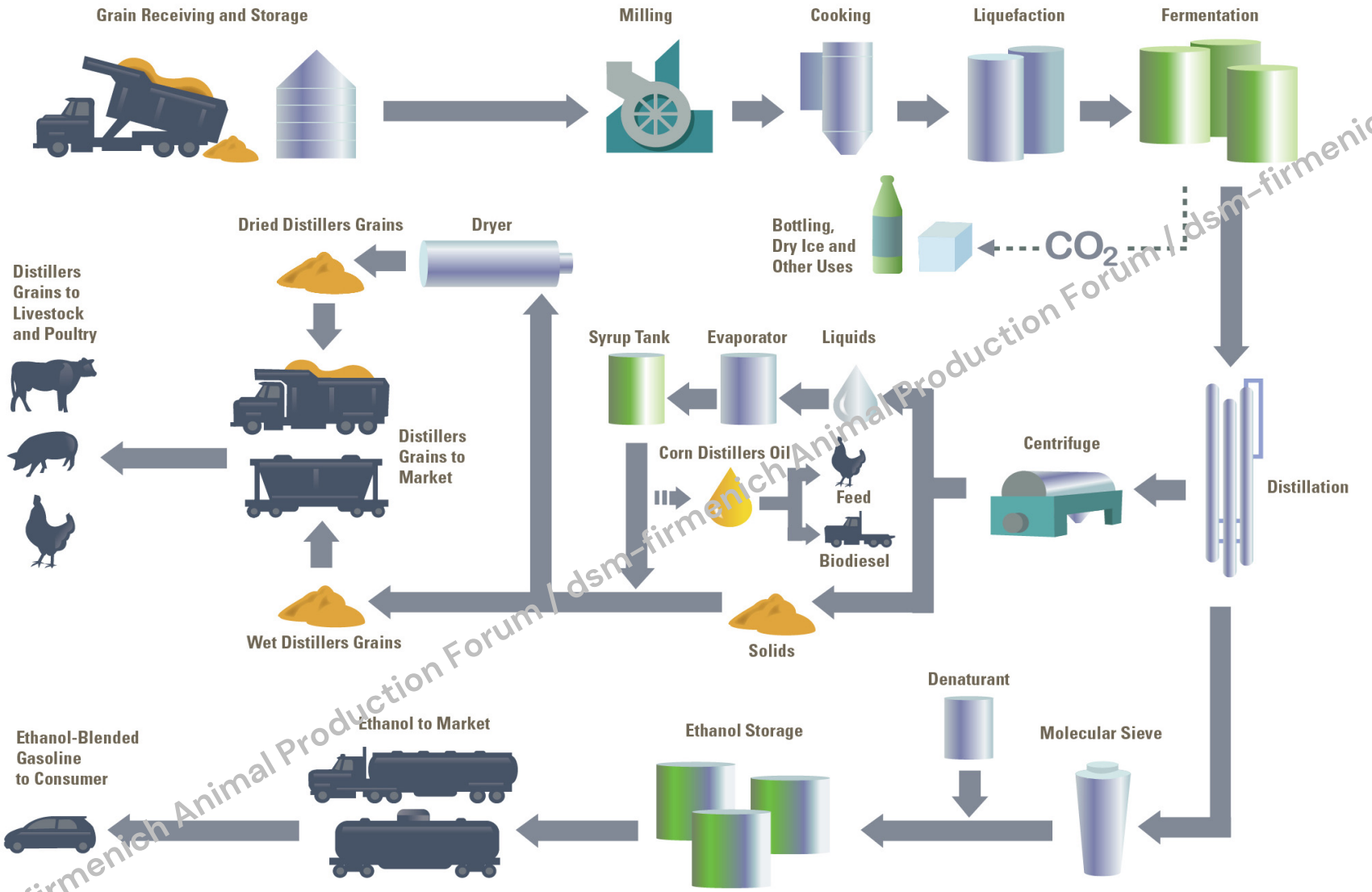
DDGS/Spot Corn @ Kansas ratio is 1.23, above the annual average of 1.02.
DDGS/soybean paste @ Kansas ratio is .47, below the annual average of .50.

Sep 21 - 29

DDGS Price Table: September 21, 2023 (USD/MT) (Quantity, availability, payment and delivery terms vary)			
Delivery Point Quality Min. 35% Pro-fat combined	**October**	**November**	**December**
FOB Vessel GULF	281	277	275
Mid-Bridge Laredo, TX	276	276	277
KC Rail Yard (delivered Ramp)	266	268	269

DDGS Price Table: September 28, 2023 (USD/MT) (Quantity, availability, payment and delivery terms vary)			
Delivery Point Quality Min. 35% Pro-fat combined	**October**	**November**	**December**
FOB Vessel GULF	261	262	262
Mid-Bridge Laredo, TX	271	271	271
KC Rail Yard (delivered Ramp)	250	251	251

Ethanol Production Process



- Simply removing the starch
- "Concentrates" nutrients 3X in distillers
- Testing throughout the process
- Effect of greater efficiency?

30% of DDGS
42% Ethanol
24% CO_2

Nutritional value

Composition of raw materials

		Corn	DDGS					DDGS proportion to corn				
Nutrientes		**Yellow**	**Normal**	**Low fat**	**Normal**	**Low fat**	**High CP**	**Normal**	**Low fat**	**Normal**	**Low fat**	**High CP**
EM Poultry	Mcal/kg	3.35	3.08	2.65	3.08	2.71	3.06					
EM Swine	Mcal/kg	3.42	3.13	2.92	3.13	2.92	3.74					
Fat	%	3.85	9.00	5.50	9.00	5.30	4.80	2.3	1.4	2.3	1.4	1.2
Protein	%	8.5	26.00	26.00	30.53	29.03	40.00	3.1	3.1	3.6	3.4	4.7
Arg	%	0.41	1.00	0.98	1.37	1.14	1.24	2.4	2.4	3.3	2.8	3.0
Lys	%	0.26	0.73	0.71	0.95	0.81	1.06	2.8	2.7	3.7	3.1	4.1
Met	%	0.18	0.48	0.43	0.56	0.68	0.77	2.7	2.4	3.1	3.8	4.3
M+C	%	0.38	1.00	0.94	1.18	1.08	1.47	2.6	2.5	3.1	2.8	3.9
Trp	%	0.07	0.21	0.21	0.25	0.24	0.24	3.0	3.0	3.6	3.4	3.4
Thr	%	0.31	1.00	0.96	1.12	1.07	1.20	3.2	3.1	3.6	3.5	3.9
LYS DIG pigs	%	0.2	0.36	0.74	0.36	0.48	0.52	1.8	3.7	1.8	2.4	2.6
MET DIG Pigs	%	0.16	0.37	0.36	0.37	0.55	0.59	2.3	2.3	2.3	3.4	3.7
TRP DIG Pigs	%	0.06	0.10	0.16	0.10	0.14	0.11	1.7	2.7	1.7	2.3	1.8
THR DIG Pigs	%	0.25	0.61	0.74	0.61	0.74	0.73	2.4	3.0	2.4	3.0	2.9
Ca	%	0.02	0.09	0.04	0.02	0.08	0.04	4.5	2.0	1.0	4.0	2.0
P Total	%	0.28	0.41	0.75	0.31	0.84	0.48	1.5	2.7	2.9	3.0	1.7
P available	%	0.08	0.17	0.57	0.49	0.54	0.20	2.1	7.1	6.1	6.8	2.5
Ash	%	1.5	2.20	5.00	2.20	6.45	2.70	1.5	3.3	1.5	4.3	1.8
Fiber	%	2.4	13.00	8.60	6.00	9.00		5.4	3.6	2.5	3.8	0.0
LYS DIG poultry	%	0.23	0.38	0.53	0.62	0.57	0.55	1.7	2.3	2.7	2.5	2.4
MET DIG Poultry	%	0.17	0.42	0.37	0.48	0.46	0.67	2.5	2.2	2.8	2.7	3.9
M+C Dig Poultry	%	0.34	0.79	0.77	0.96	0.89	1.16	2.3	2.3	2.8	2.6	3.4
TRP DIG Poultry	%	0.06	0.13	0.17	0.20	0.19	0.15	2.2	2.8	3.3	3.2	2.5
Thr DIG Poultry	%	0.27	0.78	0.69	0.81	0.80	0.94	2.9	2.6	3.0	3.0	3.5
ARG Dig Poultry	%	0.38	0.65	0.71	1.12	1.00	0.81	1.7	1.9	2.9	2.6	2.1
								3.7	**4.3**	**4.7**	**4.9**	**4.2**

3:1 ??

Analyses various, S Chárraga. different dates

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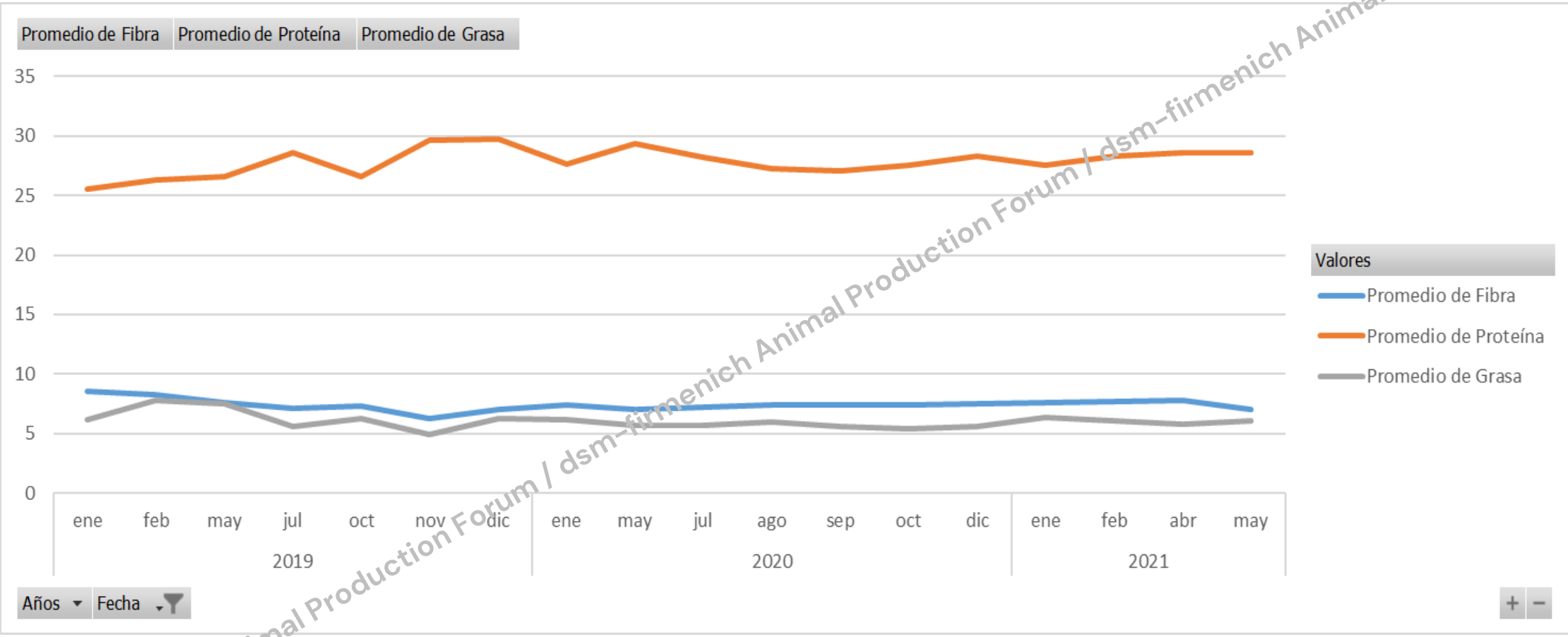
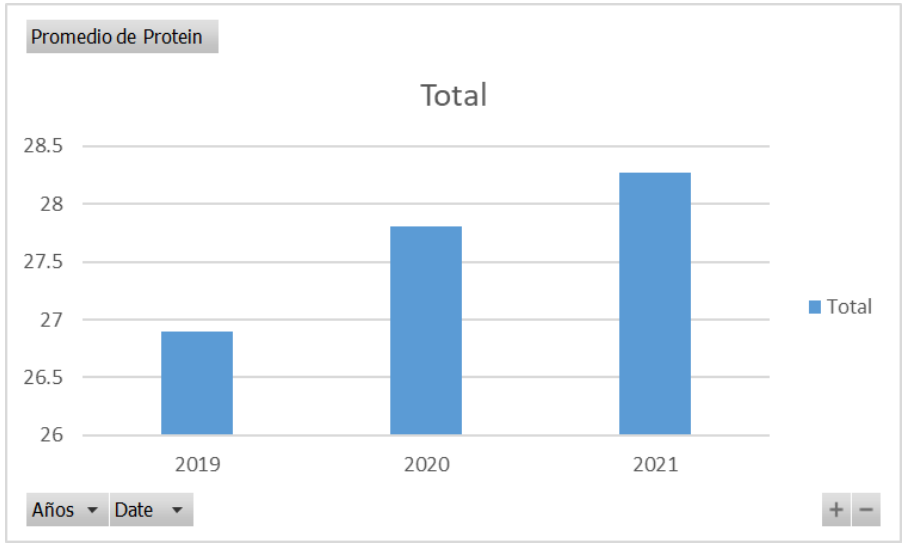
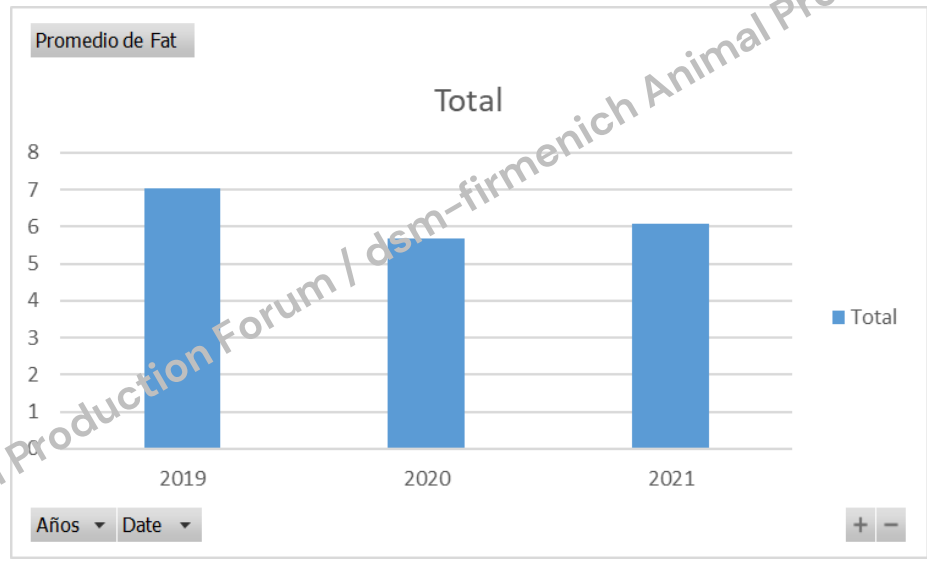
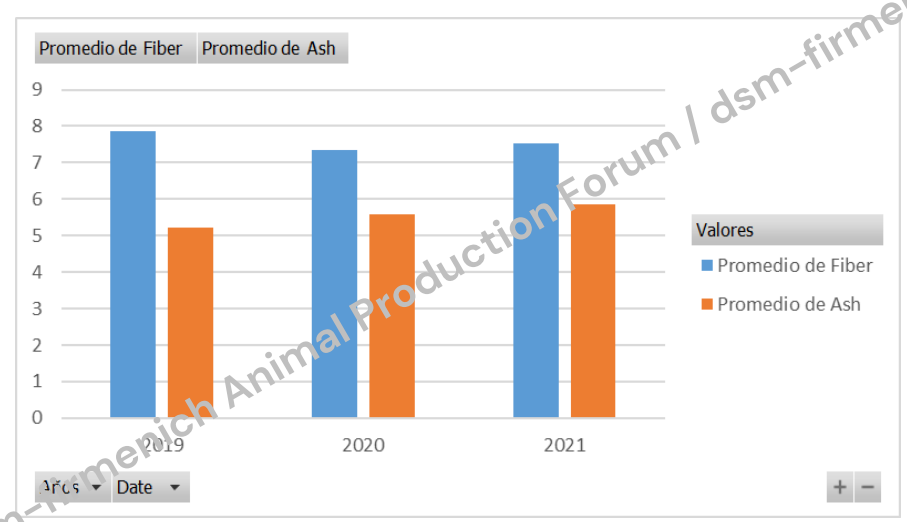
Value composition in the field



DDGS Value composition in the field

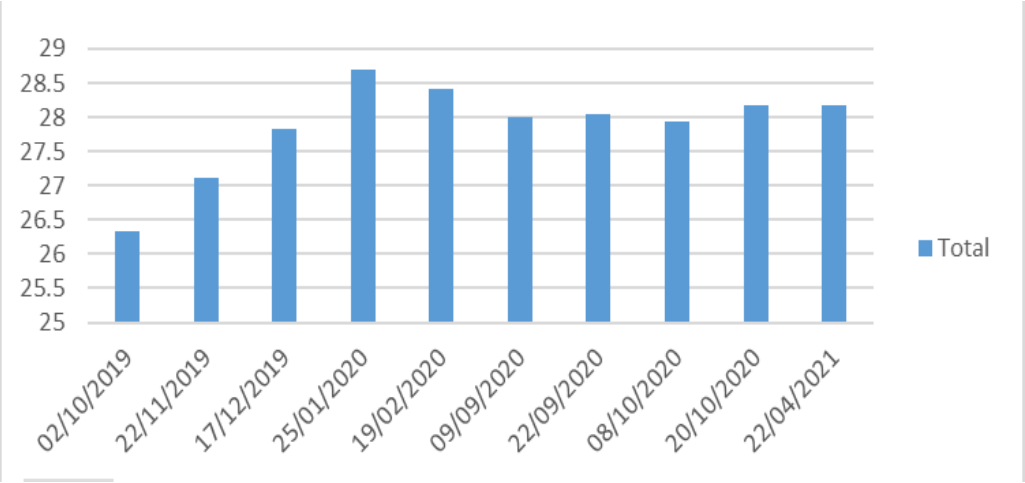




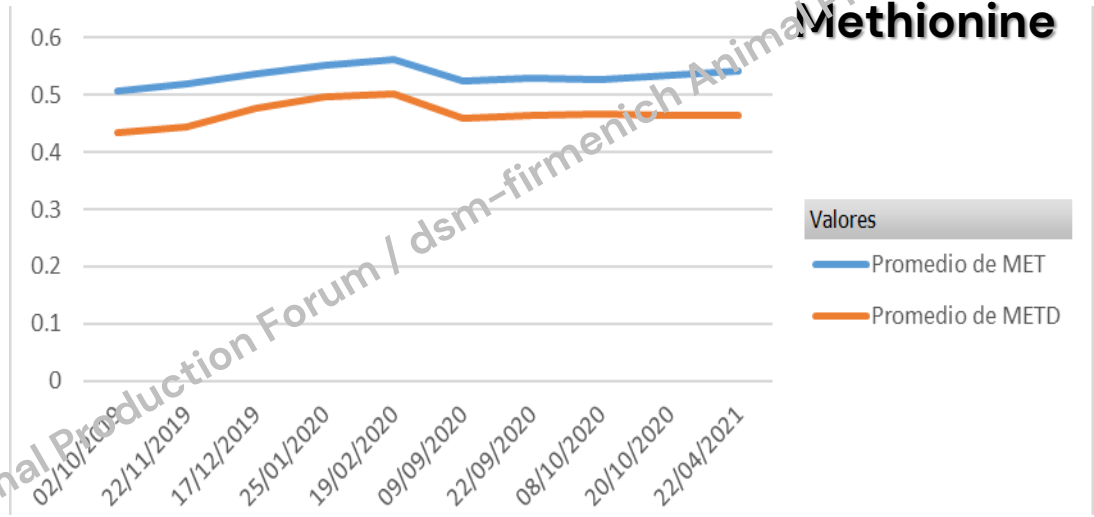


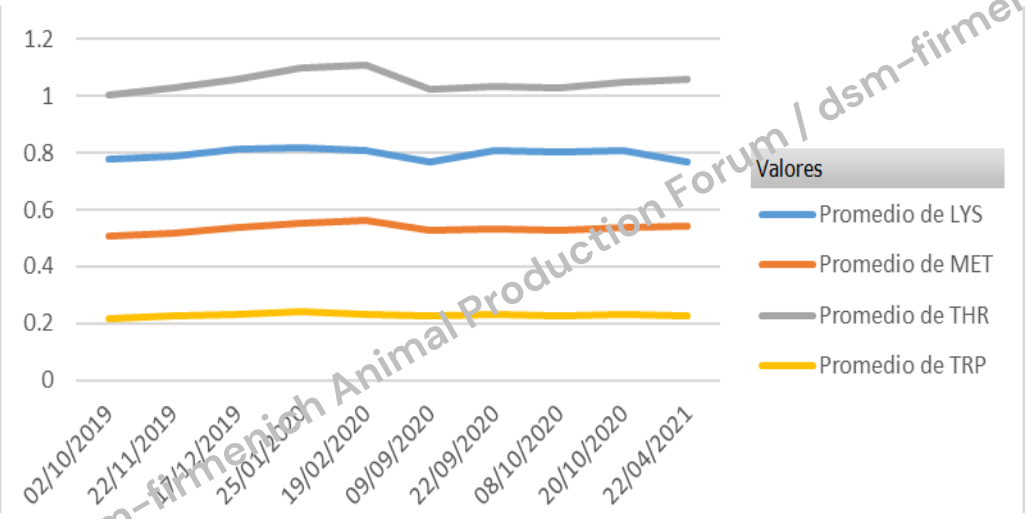
Analyses (%) by NIR; DDGS 2019-2021

Protein

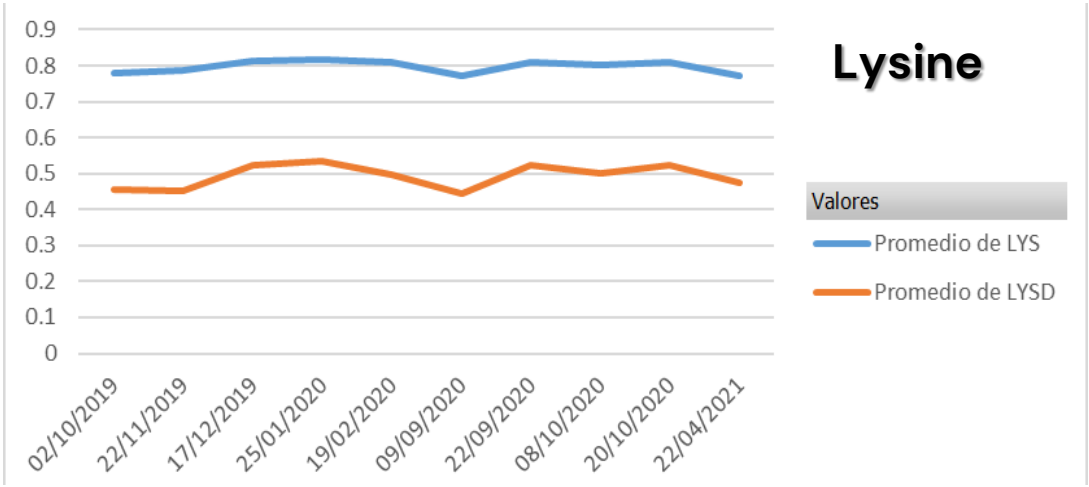


Methionine





Lysine



Lysine Improvement?

- Lys:CP increased since 2002
- Lysine content (%) increased
- Crude protein remained constant
- Suggests improvement in drying, yeasts, enzymes, processes, etc
- Change in corn varieties?

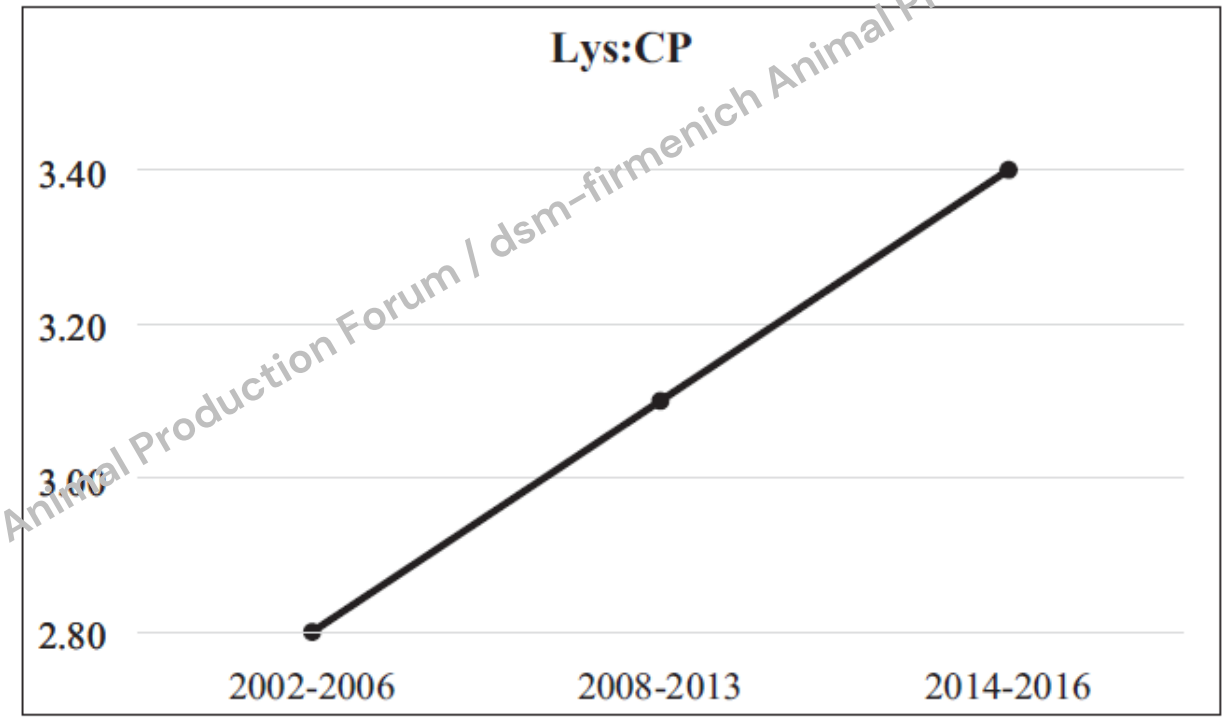


Figure 2. Lysine:crude protein of distillers dried grains with solubles from 2002 to 2016 (Spiehs et al., 2002; Fastinger and Mahan, 2006; Stein et al., 2006; Pahm et al., 2008; Stein and Shurson, 2009; Urriola et al., 2009; Han and Liu, 2010; Kerr et al., 2013; Curry et al., 2014, 2016).

Espinosa, et al., 2019

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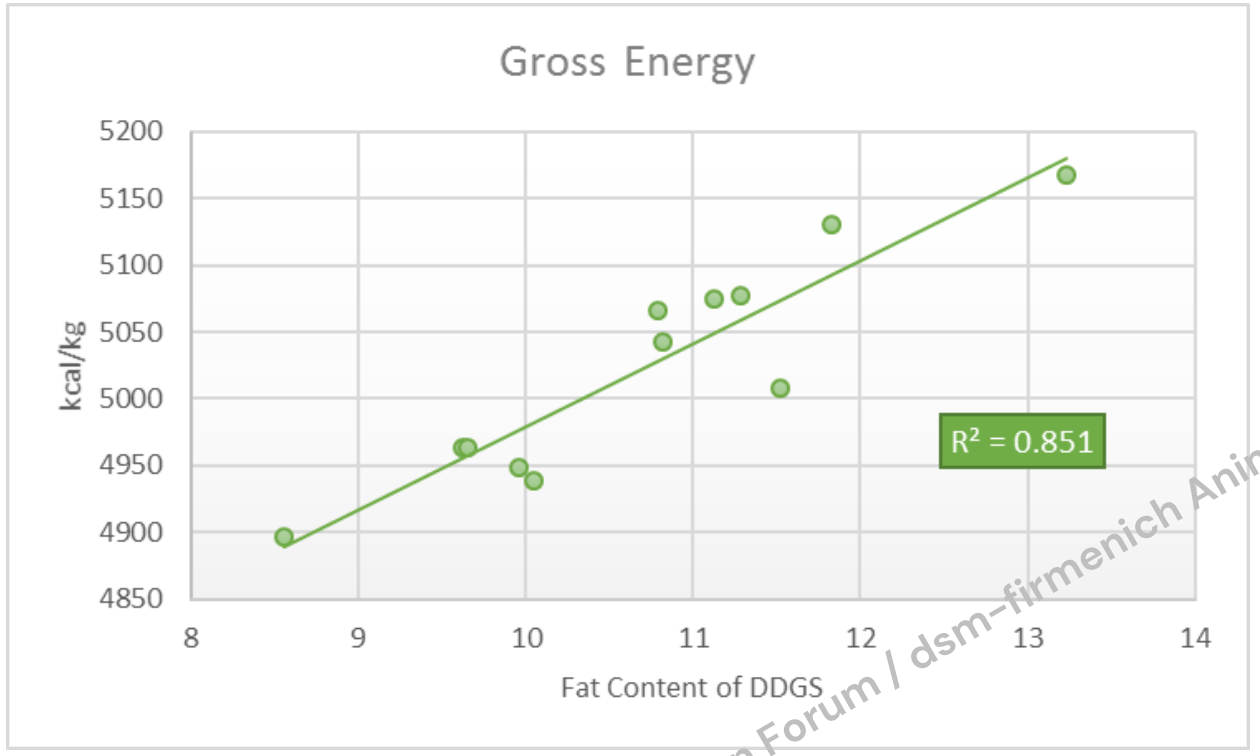
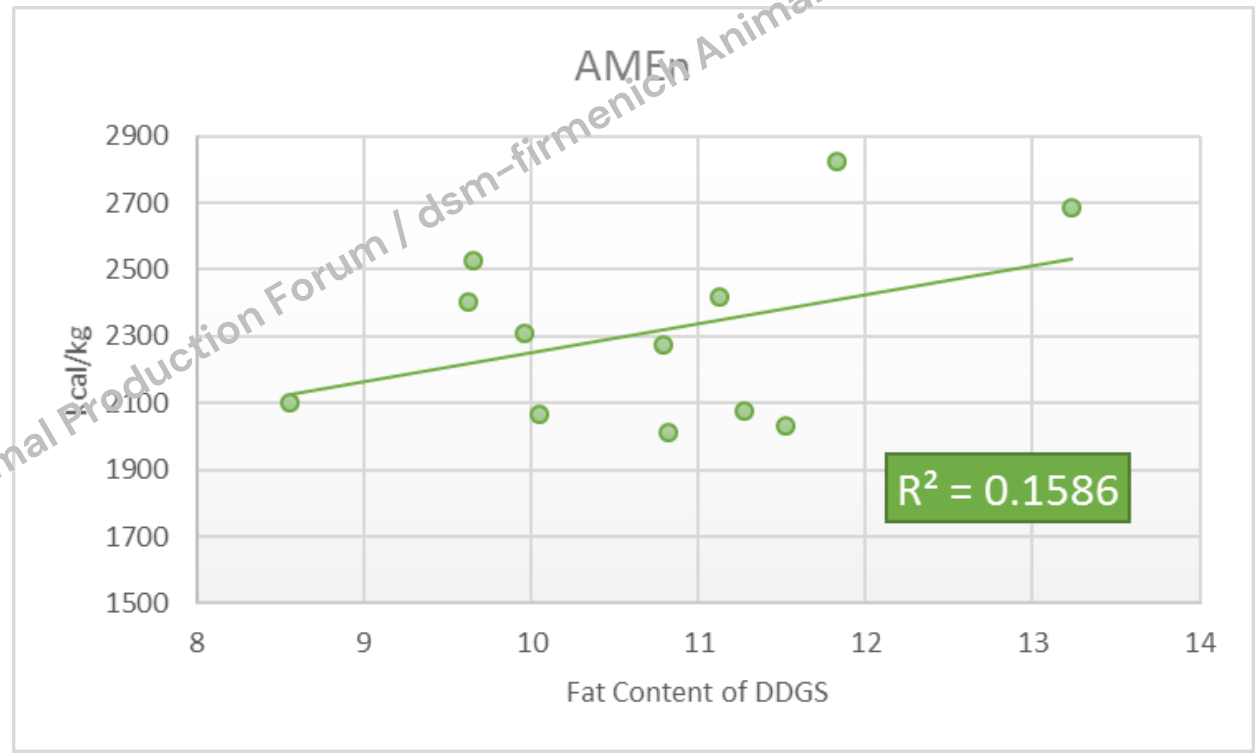
Gross Energy and AMEn



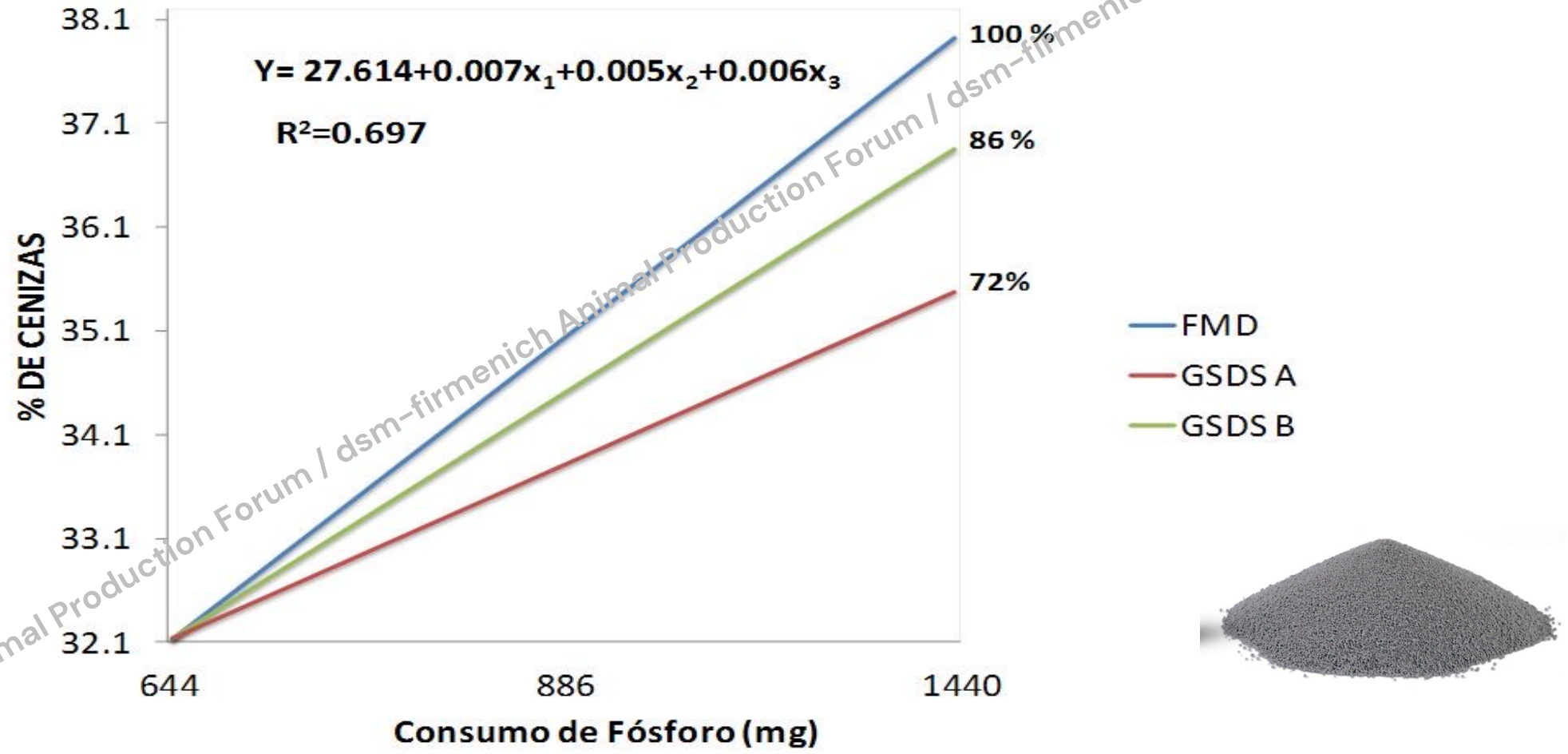


Total energy in the product – may or may not be available to the animal

Measure of the amount of energy that is digested by the animal – more precise than gross energy

Meloche, et al., 2013

Percentage of phosphorus bioavailability of two DDGS samples in relation to FMD from the ash content in tibias of 7-21 day old chickens fed with different levels of phosphorus.



Cortés et al, 2015

Digestibility results of ileal content of 7-21 day old chickens fed GSDS A and B on energy, total and digestible amino acids.

Aminoacids %	DDGS A		DDGS B	
	Total %	Digest. %	Total %	Digest. %
Met	0.55	85.3	0.57	84.7
Cys	0.48	76.6	0.49	75.0
Lys	1.00	65.4	0.98	64.6
Thr	0.93	63.2	0.96	64.1
Arg	1.17	77.0	1.11	77.7
Leu	3.15	86.7	3.34	84.0
Iso	1.07	77.8	1.08	77.8
Val	1.11	74.4	1.16	77.3
Phe	1.35	81.9	1.34	81.7
Hys	0.80	77.0	0.83	77.4
EMA_n kcal/kg	2828		2854	

Cortés et al, 2015

Analyzed composition of 8 corn distillers dried grains with solubles (DDGS) sources.

Nutrient analysis and minerals	DDGS sources 1	2	3	4	5	6	7	8	Mean	SD	CV, %
Nutrient analysis[1],											
DM, %	88.6	88.1	89.5	89.3	90.5	87.8	86.6	90.8	88.9	1.4	1.6%
Bulk density g/L	462	463	314	385	421	409	381	426	408	48.7	11.9%
Nutrient analysis[2], 88% DM											
GE kcal/kg	4,223	4,410	4,450	4,415	4,328	4,495	4,474	4,341	4,392	90.0	2.1%
CP, %	26.2	29.0	25.6	29.9	27.3	29.5	25.9	26.4	27.5	1.7	6.3%
Crude fat, %	4.8	11.2	10.9	10.0	6.0	9.9	10.7	8.5	9.0	2.4	26.7%
Acid hydrolysis fat[3], %	7.6	11.6	9.9	8.8	8.7	9.1	10.0	8.1	9.2	1.3	13.9%
Crude fiber, %	8.1	6.0	8.9	7.3	8.8	7.4	7.5	5.9	7.5	1.1	15.0%
Ash, %	5.0	4.2	3.9	4.4	4.8	4.5	4.4	4.6	4.5	0.4	8.0%
NFE (N-free extract, %)	43.6	37.9	40.9	37.2	41.7	39.4	42.1	44.9	41.0	2.7	6.5%
NDF, %	24.7	26.7	35.9	33.6	31.0	30.6	30.2	26.7	29.9	3.7	12.6%
ADF, %	9.8	14.6	14.9	13.4	14.9	14.9	11.9	10.0	13.0	2.2	17.0%
Hemicellulose[4], %	15.0	12.1	21.0	20.2	16.1	15.7	18.2	16.7	16.9	2.9	17.1%
Starch, %	2.6	0.0	0.0	0.0	1.0	0.0	0.0	6.4	1.3	2.3	180.6%
Total carbohydrate[5], %	52.0	46.1	51.8	46.3	51.1	49.0	51.2	51.6	49.9	2.5	5.0%
Total reducing sugars, %	3.5	6.5	2.3	2.8	3.8	1.6	1.9	5.4	3.5	1.7	49.6%
Minerals, 88% DM											
Ca, %	0.07	0.08	0.01	0.02	0.04	0.02	0.08	0.05	0.05	0.03	57.7%
P, %	0.95	0.57	0.72	0.82	0.82	0.85	0.79	0.83	0.79	0.11	13.9%
Na, %	0.17	0.05	0.31	0.13	0.46	0.14	0.16	0.21	0.20	0.13	61.5%
K, %	1.26	1.10	0.97	1.10	1.08	1.14	1.18	1.18	1.13	0.09	7.6%
Cl, %	0.23	0.19	0.14	0.15	0.21	0.17	0.16	0.15	0.17	0.03	17.3%
Mg, %	0.35	0.31	0.25	0.30	0.27	0.30	0.32	0.34	0.30	0.03	11.1%
Cu, ppm	5.6	22.2	5.1	6.7	6.5	5.2	3.2	3.0	7.2	6.23	86.6%
S, %	0.84	0.80	0.53	0.55	0.96	0.57	0.74	0.46	0.68	0.18	26.2%
Fe, ppm	99.1	144.7	52.6	79.8	74.6	71.4	72.0	75.5	83.0	27.32	32.9%
Mn, ppm	12.3	17.6	8.7	13.4	11.0	13.5	11.6	15.0	12.9	2.68	20.8%
Zn, ppm	88.5	83.7	69.0	87.6	74.6	74.0	79.8	91.5	81.1	8.04	9.9%
Electrolytes, mEq/Kg	334	250	341	297	417	308	325	351	328	48.10	14.7%

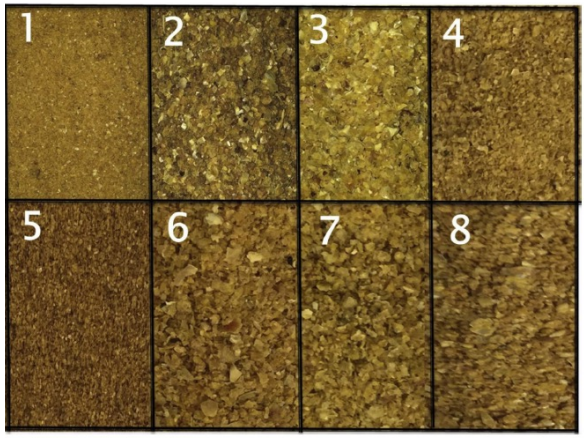
Abbreviations: ADF, acid detergent fiber; NDF, Neutral detergent fiber.

[1]Energy was analyzed by the University of Arkansas central laboratory, Fayetteville, AR; proximate, fiber and sugar analyses were determined by the University of Missouri Experiment Station Chemical Laboratories (Columbia, MO), and minerals by Tyson Corporate Lab, Springdale, AR.

DM 88.0%
CP 27.5% (25.6–29.9%),
Crude Fat 9.0% (4.8–11.2%)
Starch 1 1.3% (0–6.4%)
Particle size 895 um (462–1,529 um)

Color evaluation CV (%)
Lightness 9.0%
Redness 14.0%
Yellowness 10.0%

AMEn 2,169 (2,017–2,278 kcal/kg)



Caldas et al, 2020

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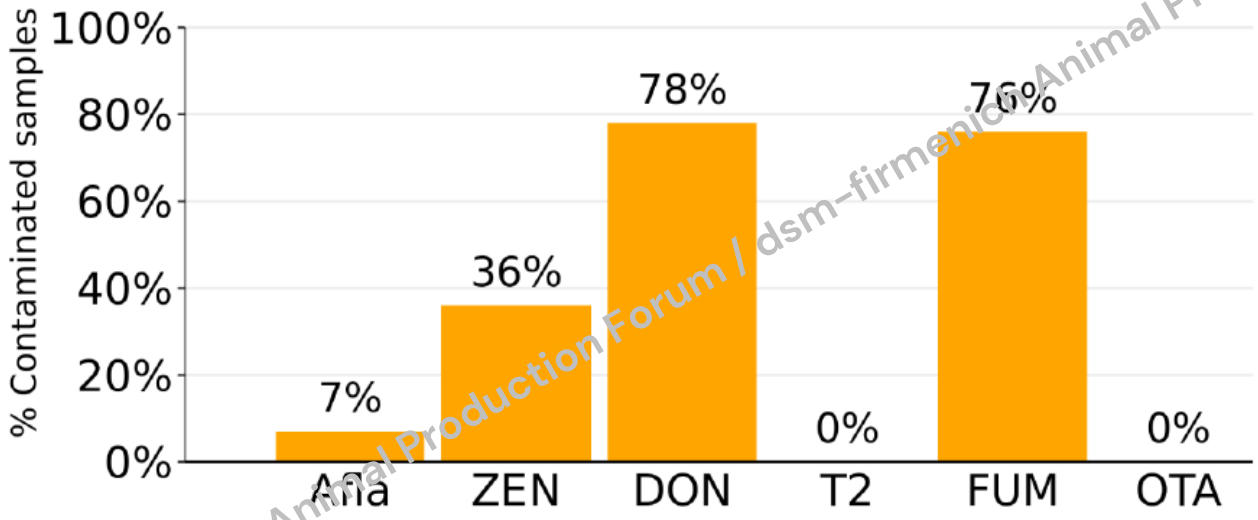
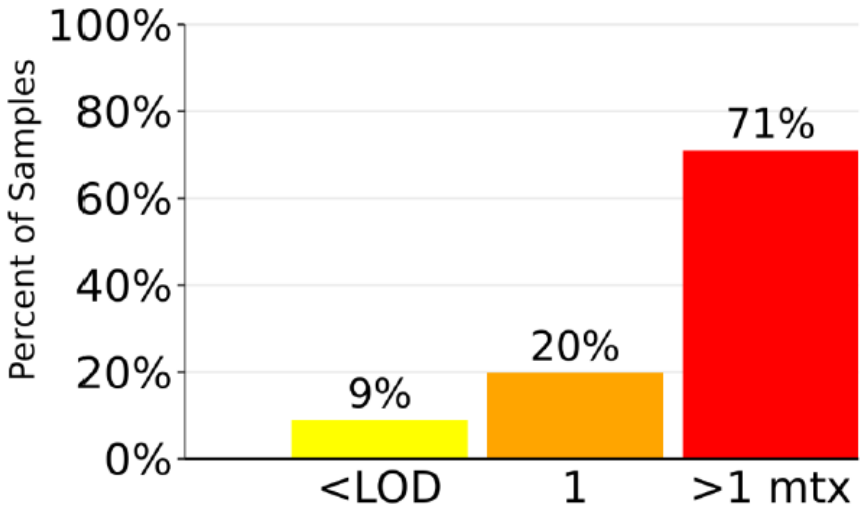
USA Corn Kernels Jan 2023 to Jun 2023

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Numero de Muestras	231	231	231	231	231	231
% Muestras Contaminadas	7%	36%	78%	0%	76%	0%
Promedio Positividad (ppb)	45	366	1353	1	3502	3
Máximo detectado (ppb)	327	4310	11300	1	83175	3

Prevalence of Mycotoxins Detected



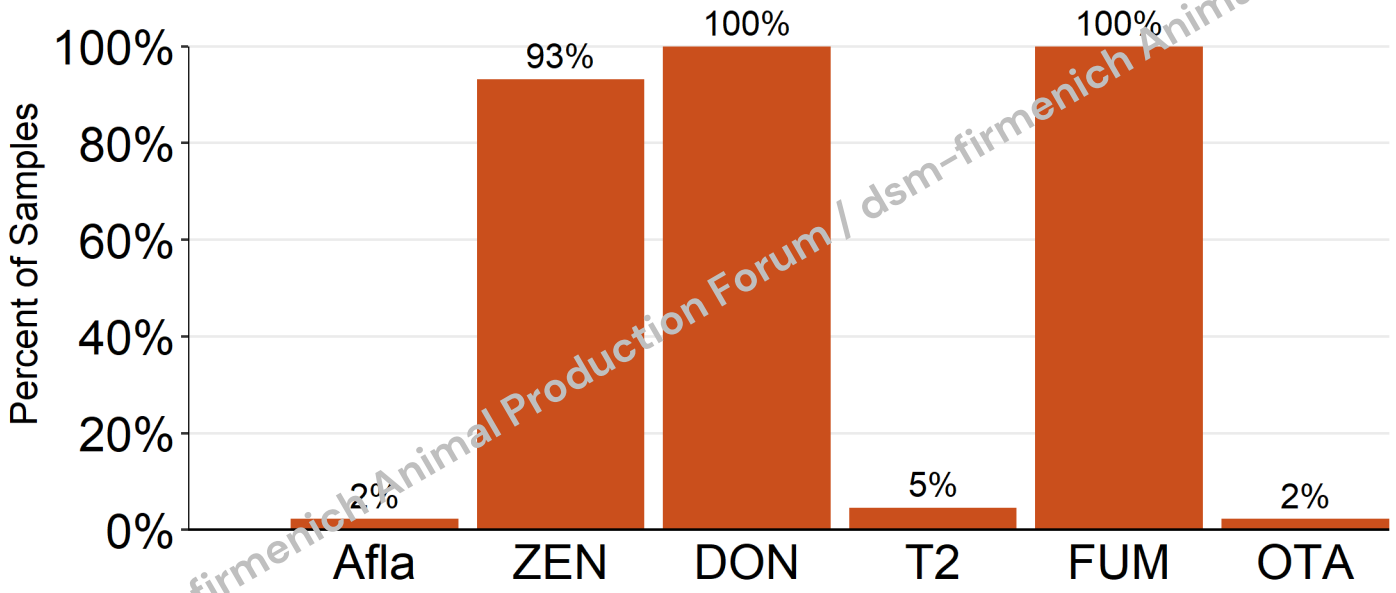
No. of Mycotoxins per Sample



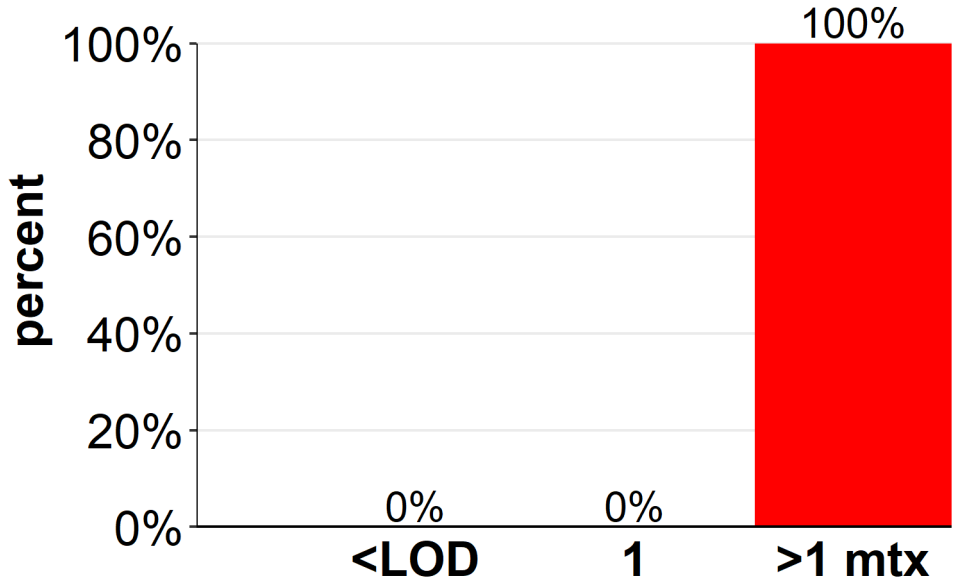
USA Corn DDGS Jan 2023 to Jun 2023

Total Risk Level: 100%*	Afla	ZEN	DON	T2	FUM	OTA
Number of samples tested	44	44	44	44	44	44
% Contaminated samples	2%	93%	100%	5%	100%	2%
Average of positive (ppb)	1	414	3809	7	1267	1
Maximum (ppb)	1	1670	16884	10	6297	1

Prevalence of Mycotoxins Detected



No. of Mycotoxins per Sample



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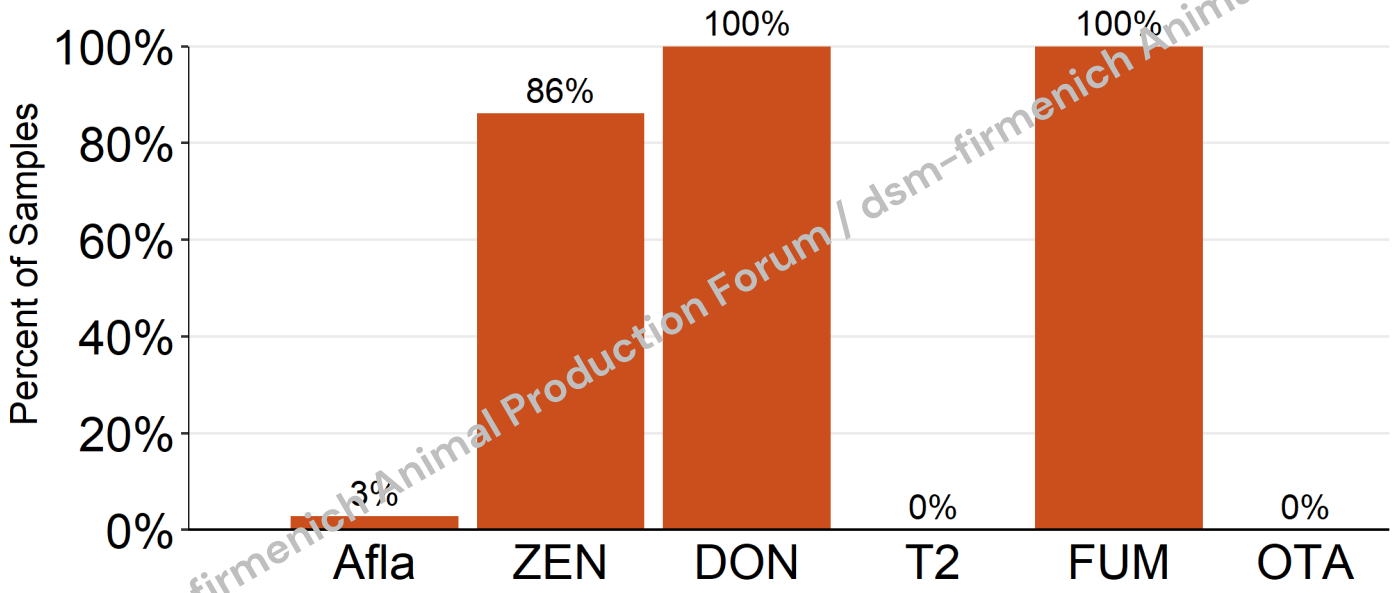
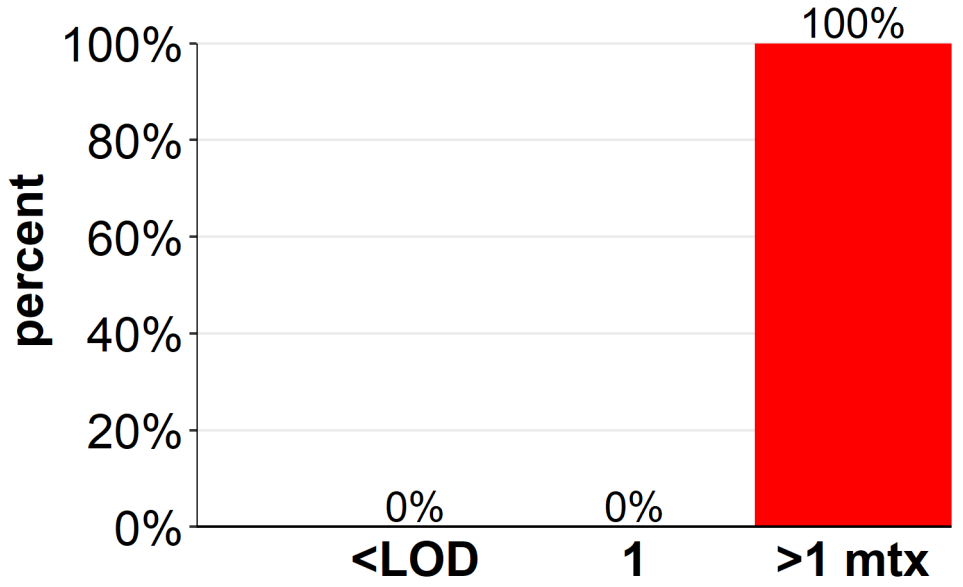
Central America Corn DDGS Jan 2023 to Jun 2023

Total Risk Level: 100%*	Afla	ZEN	DON	T2	FUM	OTA
Number of samples tested	36	36	36	36	36	36
% Contaminated samples	3%	86%	100%	0%	100%	0%
Average of positive (ppb)	5	277	2535	-	2190	-
Maximum (ppb)	5	820	5110	-	7306	-

Prevalence of Mycotoxins Detected



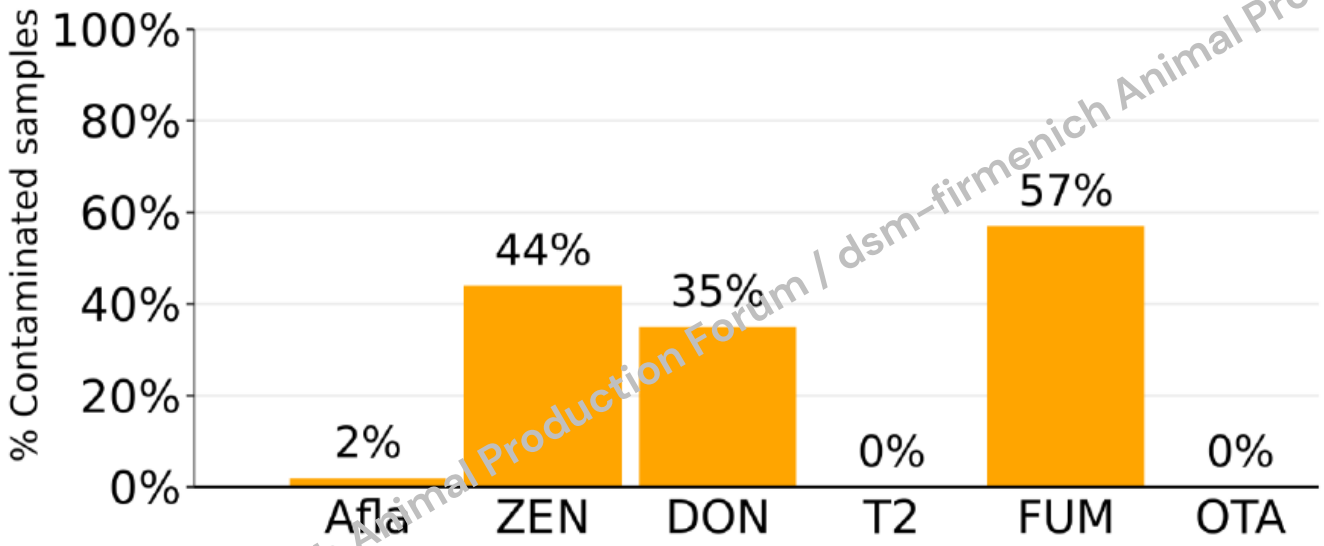
No. of Mycotoxins per Sample



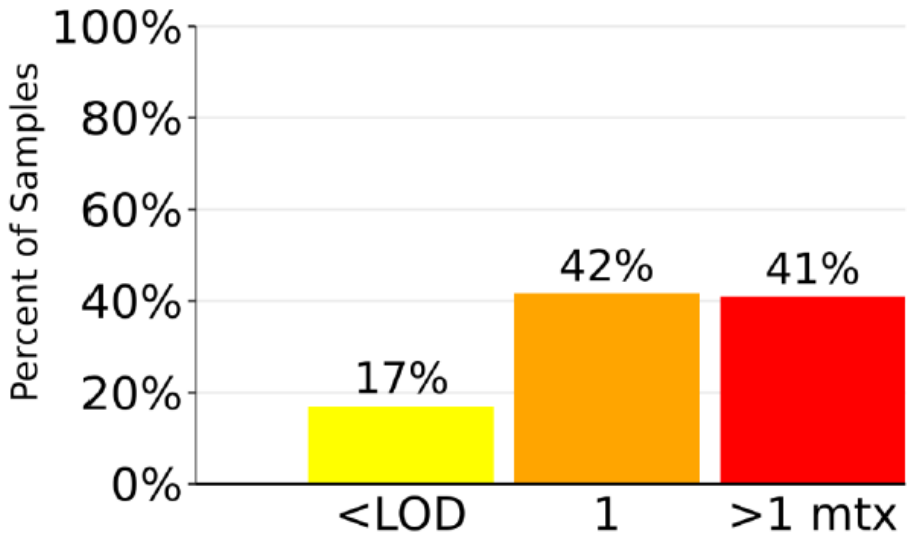
Brazil Corn Kernels Jan from 2023 to Jun 2023

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Numero de Muestras	603	580	610	63	610	18
% Muestras Contaminadas	2%	44%	35%	0%	57%	0%
Promedio Positividad (ppb)	27	132	511		1087	
Máximo detectado (ppb)	119	2612	1930	0	5640	0

Prevalence of Mycotoxins Detected



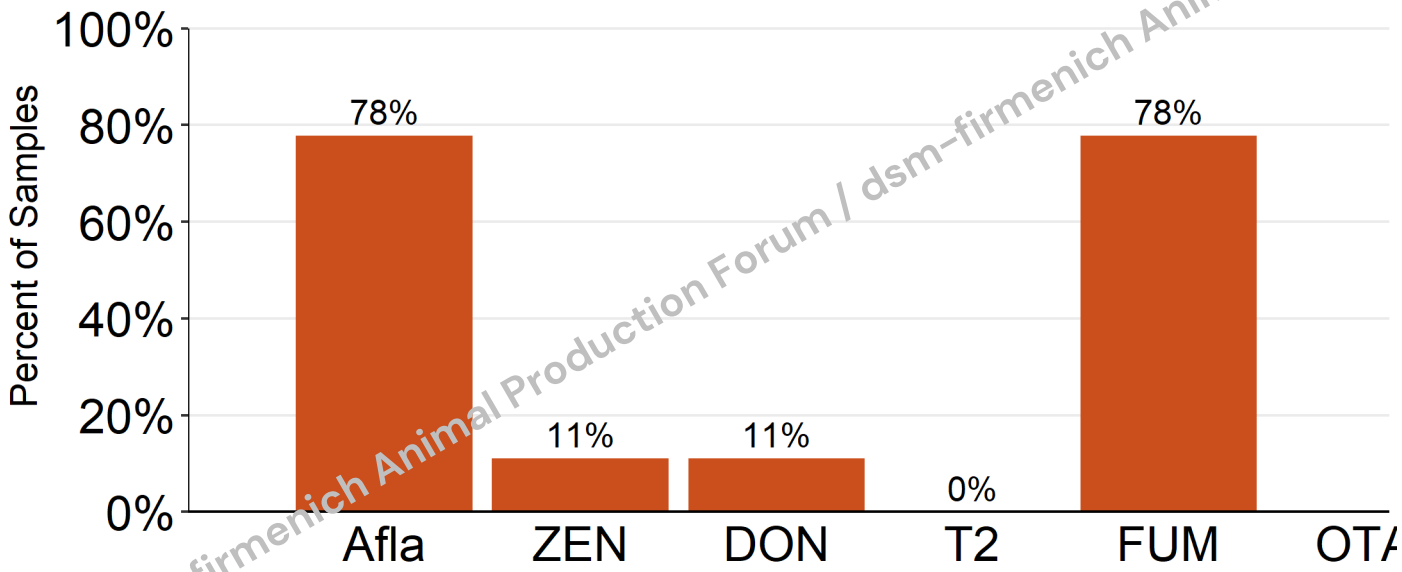
No. of Mycotoxins per Sample



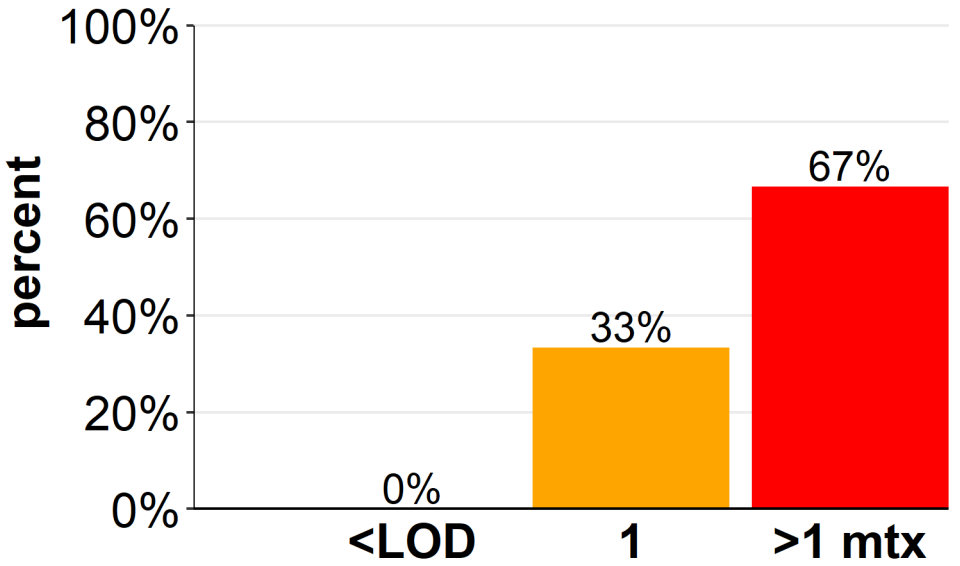
Brazil Corn DDGS Jan 2023 to Jun 2023

Total Risk Level: 78%*	Afla	ZEN	DON	T2	FUM	OTA
Number of samples tested	9	9	9	1	9	0
% Contaminated samples	78%	11%	11%	0%	78%	-
Average of positive (ppb)	5	34	400	-	949	-
Maximum (ppb)	6	34	400	-	1930	-Inf

Prevalence of Mycotoxins Detected



No. of Mycotoxins per Sample



Summary mycotoxin Jan 2023 to Jun 2023

Origen/product		Afla	ZEN	DON	T2	FUM	OTA
USA	Corn	45	366	1353	1	3502	3
USA	DDGS	1	414	3809	7	1267	1
Central America	DDGS	5	277	2535	-	2190	-
Brasil	Corn	27	132	511	-	1087	-
Brasil DDGS	DDGS	5	34	400	-	949	-

Use of enzymes

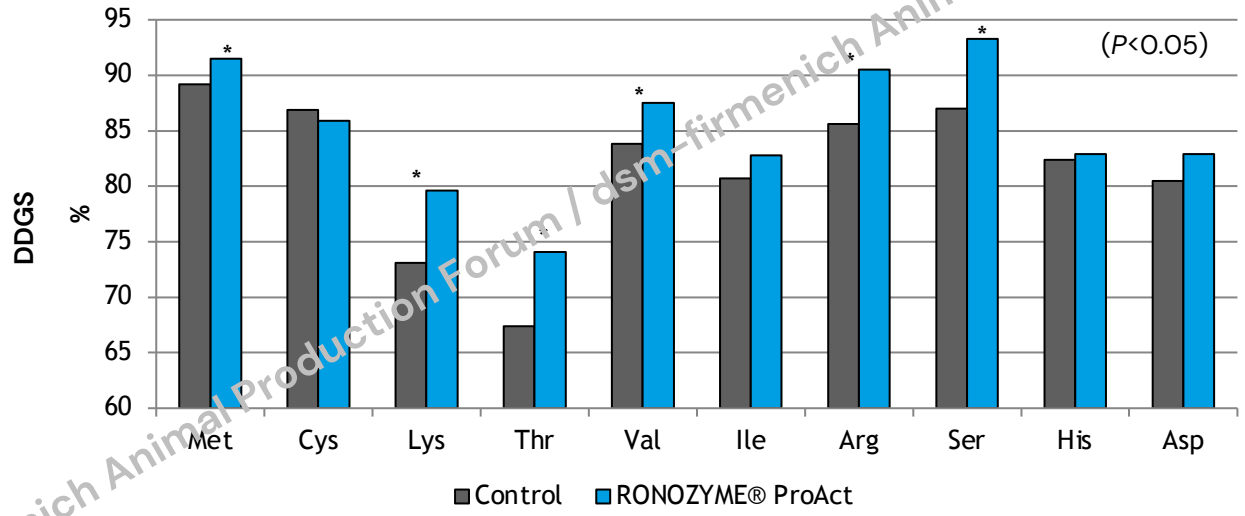
Effect of RONOZYME® ProAct on AA Digestibility in DDGS, Bakery By-Product Meal in layers

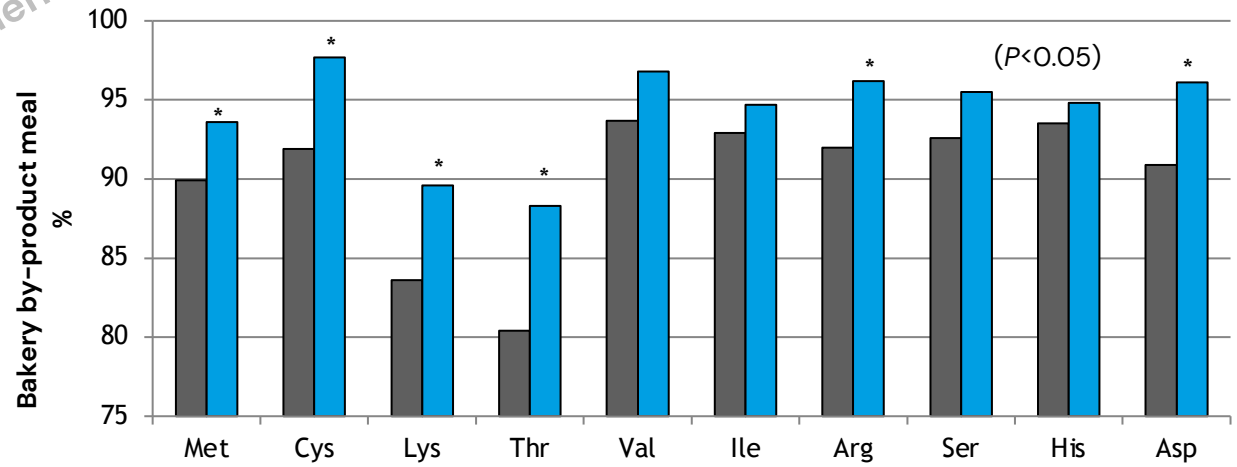
Trial details

- **Breed:** Hyline W36 white leghorn hens 56 weeks of age
- **Basal Diet:** 75% corn DDGS or 96% bakery-by-product meal
- **Experimental:** 6 replicates/treatment, 4 birds per cage
- **Treatments:**
  - Control
  - RONOZYME® ProAct 200ppm
- **Parameters measured:** amino acid true ileal digestibility % in DDGS & bakery by-product meal based diets

Conclusion & Benefits

- Supplementation with RONOZYME® ProAct improved true ileal of the amino acids tested
- The effect and magnitude was amino acid dependent





Source: Angel, R. et al. Effects of a mono component protease on true ileal amino acid digestibility of selected ingredients for commercial laying hens. Abstract 508-Poster- PSA 2011

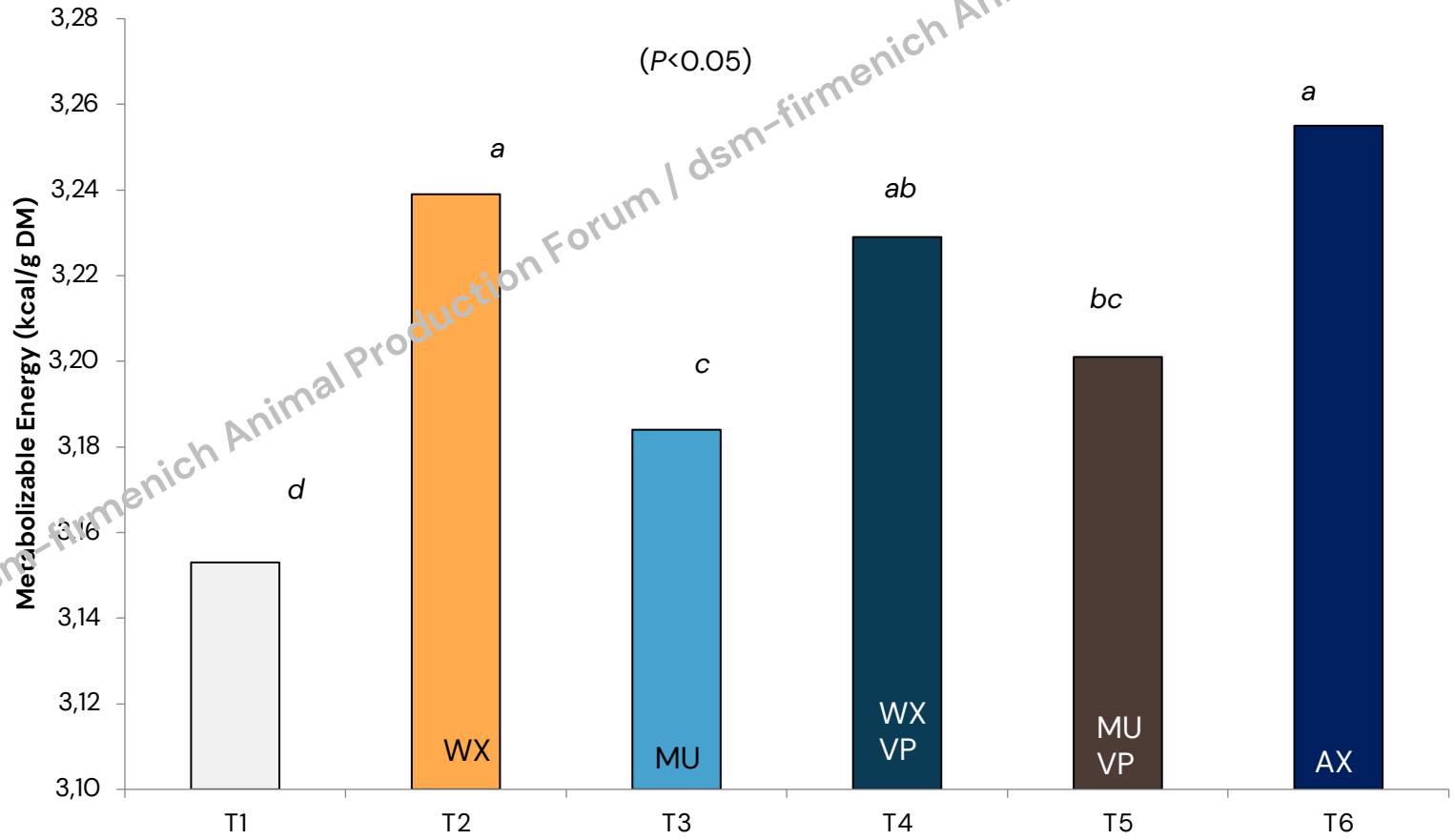
Effect of Carbohydrase Enzymes on a Broiler Diet with 15% DDGS

Objective

To determine metabolizable energy (ME) for commercial broiler chicks fed various carbohydrase enzymes and combinations thereof added to a corn-soybean meal-DDGS diet

Trial details

- **Breed:** 360 male Ross Broiler chicks
- **Basal Diet:** corn (50%), SBM (27%), DDGS (15%)
- **Experimental:** 12 replicates of 5 chicks for each treatment
- **Treatments:**
  - T1-Negative Control (NC) no enzymes
  - T2-RONOZYME® WX, 270 mg/kg feed
  - T3-RONOZYME® MultiGrain: 130 mg/kg feed
  - T4:RONOZYME® WX (85 mg/kg) + RONOZYME® VP (185 mg/kg)
  - T5:RONOZYME® MultiGrain(90 mg/kg) + RONOZYME® VP (185 mg/kg)
  - T6:RONOZYME® AX (330 mg/kg)
- **Parameters measured:** metabolizable energy (kcal/g DM) at day 21



Conclusions & Benefits

- Supplementation with RONOZYME® WX, RONOZYME® MultiGrain, alone and combined with RONOZYME® VP and RONOZYME® AX significantly increased the MEn of a corn-soybean meal diet containing 15% DDGS

Source: Poster- Utterback, P.L. et al. PSA 2008. Evaluation of Various Carbohydrase Enzymes in Broiler Chicks.

Performance

Effect of enzymes protease and xylanase in broiler

1,900 1-day-old male and female chicks; Ross 308 Chicken

4 treatments with 9 or 10 replicates each (25 males and 25 females each), 10 chicks/m2

Food: Corn, soy and DDGS

Statistical analysis: unbalanced, CDA

Parameters evaluated: GDP, CDA, IPE

46 days old.

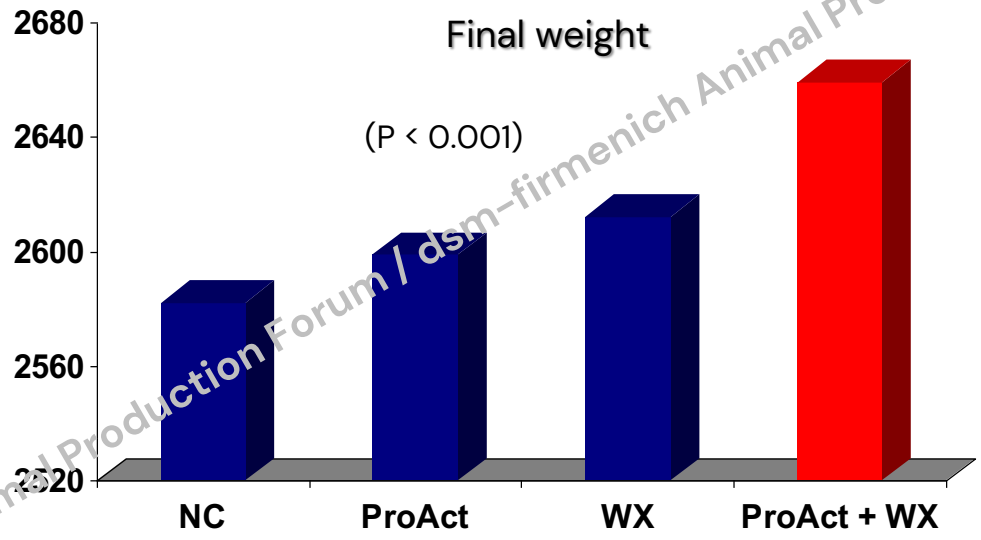
T1: Control -60 kcal, -4% aa´s

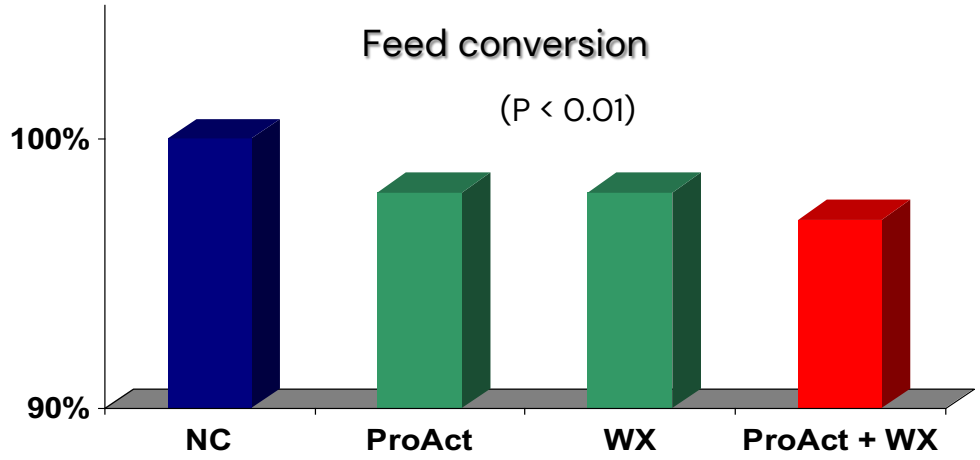
T2: (T1 + 200 ppm R. ProAct

T3: (T1 + 150 ppm R. WX)

T4: (T1 + 200 ppm R. ProAct + 150 ppm R. WX)

All diets added with phytase

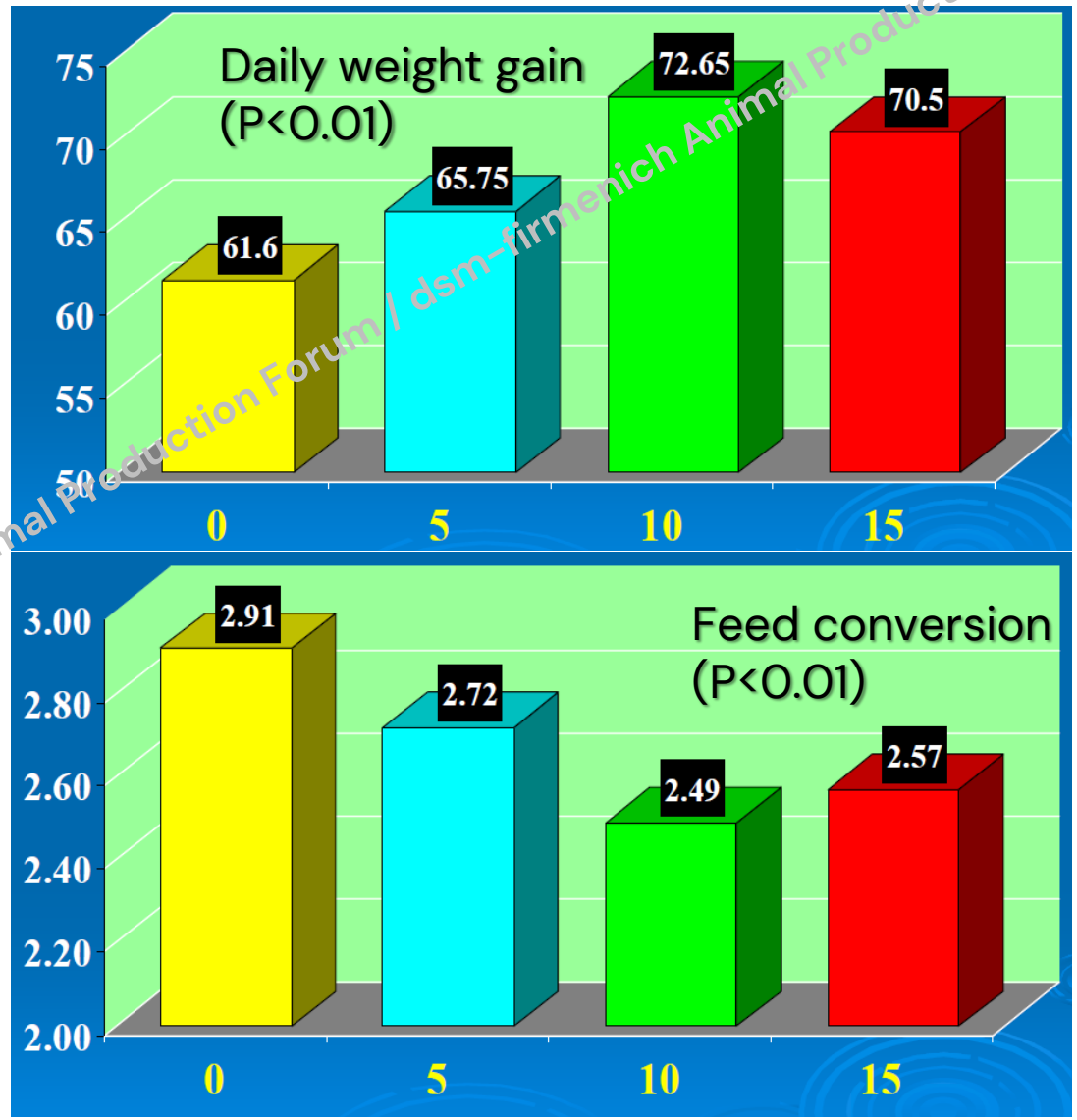




Adee et al, 2010

Effect of level inclusión DDGS in diets for finisher broilers on performance

- Broilers chickens Ross 308 male
- 35-49 days old
- Two type diets; sorghum/corn
- DCA
- 3 levels DDGS; 5, 10 or 15%



Gomez y Angeles 2008

Effect of carbohydrases in laying hen diets for 12 wks: Exp 1

	Prod Huevo (%)	CDA (g/g/d)	CA	Peso de huevo (g)	Masa (g)
Control	80.00	98.8 b	1.953 a	63.3 a	50.6
17% DDGS	78.10	99.9 b	2.048 b	62.6 bc	48.9
Blend 25	78.50	103.6 a	2.105 b	62.7 b	49.2
RV	79.00	101.1 ab	2.058 b	62.2 c	49.2
EEM	0.86	0.757	0.0217	0.21	0.631
P<	0.44	0.001	0.0003	0.01	0.11

*All diets included phytase of Peniophora lycii

Ramírez y Fernández, 2009

Effect of carbohydrases in laying hen diets for 12 wks: Exp 2

	Prod Huevo (%)	CDA g/g/d	CA	Masa (g)	Prod Huevo ($)	Alimento $/kg
Control	81.40	100	1.944 ab	51.6	100.0 b	100
Blend	83.50	101	1.916 a	52.7	97.5 a	99
Blend + P	80.80	101	1.980 bc	50.9	99.8 ab	98
RV	80.10	102	2.019 c	50.8	101.1 b	97
EEM	0.99	0.72	0.02	0.629	0.96	
P<	0.11	0.23	0.004	0.14	0.08	

*All diets included phytase of Peniophora lycii and was used 15% DDGS

Ramírez y Fernández, 2009

Productive performance results in bovans hens (76-86 wks) fed with two levels of reduced oil DDGS

Treatment	Egg prod. (%)	Egg weight (g)	Feed consumption (g)	Feed conversion	Egg mass(g)
1.- Basal*	87.2	64.6	108	1.93	56.3
2.- 1 +DDGS A 6%	87.1	64.7	109	1.94	56.3
3.- 1 + DDGS A 12%	87.6	64.3	107	1.91	56.3
4.- 1 + DDGS B 6%	88.1	65.0	109	1.92	57.2
5.- 1 + DDGS B 12%	86.1	64.6	108	1.96	55.6

* Basal → Sorghum + Soybean

Cortés et al, 2015

Evaluation of yolk pigmentation with the DSM´s fan and photocolorimeter

5 treatments were added with the following amounts of pigment:

Week 1 – 4: 8 ppm of lutein (*Tagetes erecta*).
Week 5 – 7: 8 ppm of lutein + 1 ppm canthaxanthin.
Week 8 –10: 8 ppm of lutein + 2 ppm canthaxanthin.

Treatment
1.- Basal*
2.- 1 +DDGS A 6%
3.- 1 + DDGS A 12%
4.- 1 + DDGS B 6%
5.- 1 + DDGS B 12%

Cortés et al, 2015

Results in egg yolk pigmentation with reflectance photocolorimeter (CieLab) and DSM fan from week 1-4

Treatments	Luminosity (l)	Yellow (a)	Red (b)	DSM
1.- Basal*	57.8	36.5 a	-7.03 a	3.3
2.- 1 +DDGS A 6%	61.2	40.1 ab	-6.75 ab	3.7
3.- 1 + DDGS A 12%	64.6	42.6 b	-6.10 b	3.8
4.- 1 + DDGS B 6%	64.6	39.6 ab	-6.69 ab	4.0
5.- 1 + DDGS B 12%	65.0	42.9 b	-6.17 b	4.0

* Basal → Sorghum- Soybean

(P<0.05)

Cortés et al, 2015

Results in egg yolk pigmentation with reflectance photocolorimeter (CieLab) and DSM fan from week 5-7

TRATAMIENTOS	L	a	b	DSM
1.– Basal*	63.4	38.0a	-1.80	8.4 a
2.– 1 +DDGS A 6%	62.5	39.6ab	-2.16	8.9 ab
3.– 1 + DDGS A 12%	62.0	41.7b	-1.48	9.5 b
4.– 1 + DDGS B 6%	63.2	39.5ab	-2.30	8.8 ab
5.– 1 + DDGS B 12%	61.7	42.3b	-1.40	9.1 b

* Basal → Sorghum + Soybean

(P<0.05)

Cortés et al, 2015

Results in egg yolk pigmentation with reflectance photocolorimeter (CieLab) and DSM fan from week 8-10

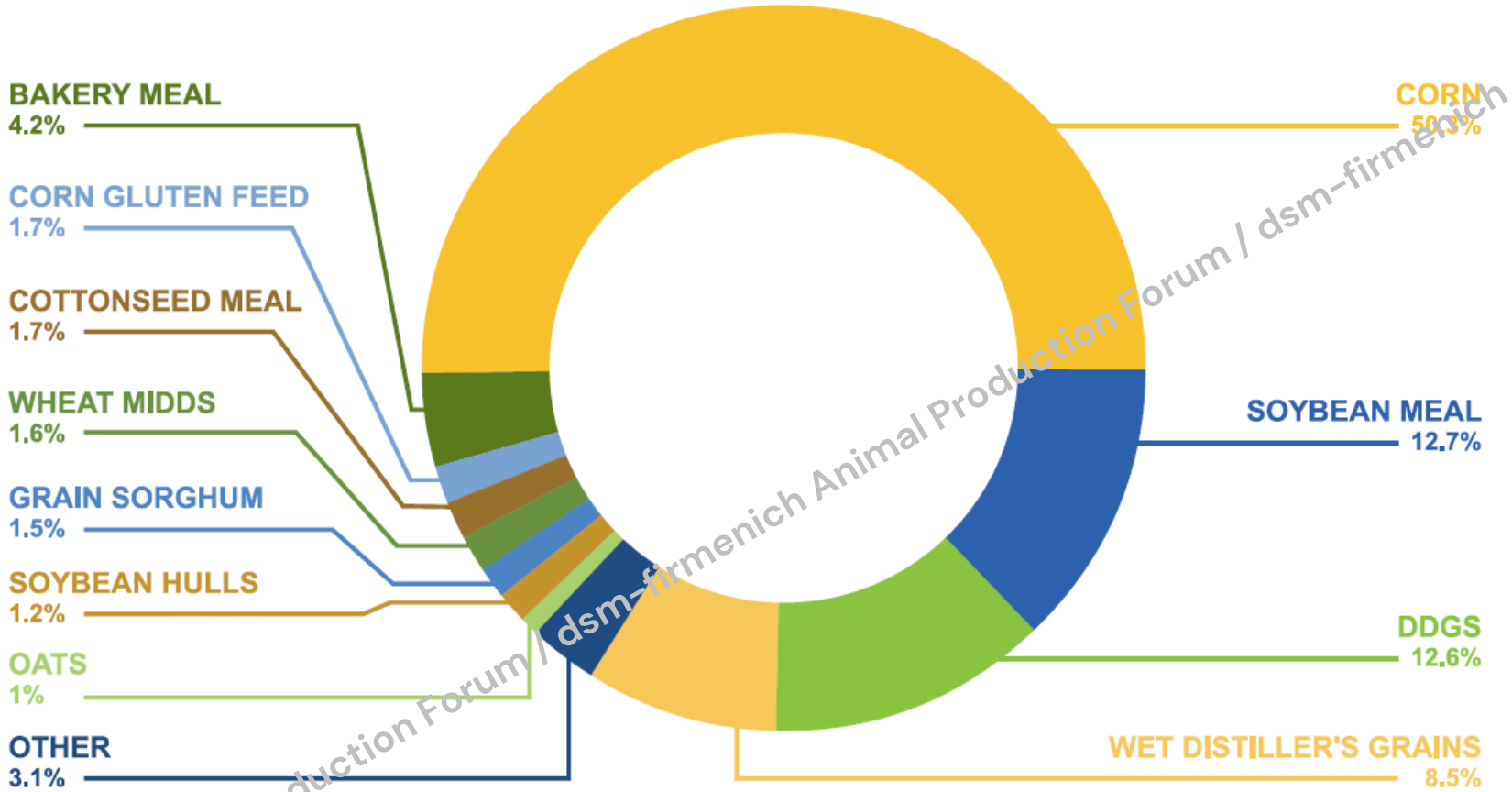
TRATAMIENTOS	L	a	b	DSM
1.– Basal*	63.0	41.6 a	0.83	8.92 a
2.– 1 +DDGS A 6%	63.0	44.9 b	0.82	9.35 ab
3.– 1 + DDGS A 12%	63.4	46.4 b	0.77	9.78 ab
4.– 1 + DDGS B 6%	62.5	45.0 b	0.39	9.50 ab
5.– 1 + DDGS B 12%	62.1	45.2 b	1.36	10.14 b

* Basal → Sorghum- Soybean

(P<0.05)

Cortés et al, 2015

The Average Diet and Ingredient Type



AFIA, 2018

U.S. GRAINS COUNCIL

DDGS Substitution

- Soybean meal contains 2,300 kcal/kg and 48% protein vs DDGS with 3,000 kcal/kg and 28% protein
- Can’t replace 1:1
- DDGS provides multiple nutrients
  - Energy
  - Protein and amino acids
  - Phosphorous

Diet cost impact of DDGS inclusion

Diet: Layers hens 17-30 weeks winter					
Ingredient	**$/kg**	**Kgs/ton**			
Yellow corn 7.5%	$ 0.27	609.67	585.67	578.46	570.72
Soybean meal 46%	$ 0.54	254.00	222.00	211.00	200.00
DDGS (golden)	$ 0.35		**60.00**	**80.00**	**100.00**
Limestone 38 %	$ 0.04	55.00	56.00	56.00	56.00
Limestone 38 % grit	$ 0.03	40.00	40.00	40.00	40.00
Soybean oil	$ 1.47	22.00	18.00	16.50	15.50
Ortophosphate 21%	$ 0.85	7.50	7.00	6.50	6.00
Premix	$ 3.70	5.00	5.00	5.00	5.00
Salt	$ 0.32	3.00	3.00	3.00	3.00
Bicarbonate Na	$ 0.56	1.23	1.28	1.30	1.31
Choline 60 %	$ 1.33	1.00	1.00	1.00	1.00
Methionine 99 %	$ 2.02	1.60	1.05	1.02	1.00
Lysine 78%	$ 1.44			0.22	0.47
Total		1000	1000	1000	1000
$/ton (dls)		$ 366.49	$ 356.22	$ 352.92	$ 350.27
(profit)			**-$ 10.26**	**-$ 13.57**	**-$ 16.22**

Diet cost impact of DDGS inclusion

Diet: Broiler finisher +46 d					
Ingredient	**$/kg**	**Kgs/ton**			
Yellow corn 7.5%	$ 0.27	726.01	685.47	672.46	658.45
Soybean 46%	$ 0.54	227.00	208.00	202.00	196.00
DDGS (golden)	$ 0.35		**60.00**	**80.00**	**100.00**
Soybean oil	$ 1.47	16.00	15.50	15.00	15.00
Limestone 38 %	$ 0.04	11.00	12.00	12.00	12.00
Premix w/CR/CY	$ 4.32	6.50	6.50	6.50	6.50
Pigment 30 g	$ 2.27	2.90	2.85	2.85	2.85
Lysine 78%	$ 1.44	1.85	2.16	2.26	2.35
Ortophosphate 21%	$ 0.85	3.50	2.50	2.00	2.00
Methionine 99 %	$ 2.02	2.25	2.08	2.02	1.96
Bicarbonate Na	$ 0.56	1.50	1.50	1.50	1.50
Salt	$ 0.32	1.30	1.30	1.30	1.30
Treonin	$ 1.83	0.19	0.14	0.11	0.09

Total		1000	1000	1000	1000
$/ton (dls)		$ 386.68	$ 384.72	$ 383.73	$ 383.65
(profit)			**-$ 1.96**	**-$ 2.95**	**-$ 3.03**

Summary

- The use of DDGS in formulation is real alternative; There is solid information/research.
- It is necessary to know/analyze the nutritional profile of DDGS.
- It is important to monitor the quality of DDGS.
- The use of specific enzymes allows to better express the productive response with DDGS.
- Formulation with DDGS maintains productive performance and allows savings in diet cost.
- There are other benefits with DDGS that require review; pigment, minerals.

Obrigado | Gracias | Thank you