

# Use of sorghum in feed nutrition



2<sup>nd</sup> European Sorghum Congress 2018

#### **IDENA: FRENCH COMPANY**

#### 2 CORE BUSINESSES: PREMIXES / HOME MADE FEED ADDITIVES





- \* Team of experts in animal nutrition
- \* Innovative concepts for welfare, demedication, ...
- \* 25 years of experience



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Main datas about sorghum Sorghum a reliable crop

#### **MAIN DATAS ON SORGHUM**

- One of the 5 major cereals (Rice, Wheat, Corn, Barley)
- 62 MT produced in the world but only 1 in Europe
- 56% for food, 44% for feed
- Cereal resistant to drought (efficiency of root system)





#### **COMPOSITION OF SORGHUM GRAIN**

- High content of starch→ source of energy
- Good level of protein
- Antinutritional factors? Confusion with tannins (Bird resistant sorghums not cultivated in Europe)

 1%
 2%

 1%
 5%

 9,50%
 3%

 65%
 3%

 65%
 65%

 Humidity
 Crude Protein
 Fat
 Starch

 Sugars
 Crude Fiber
 Ash
 QSP

Sorghum grain composition

*High level of starch, average 10% protein: competitive with other RM in feed factories* 



#### SORGHUM: RICH IN STARCH→ ENERGETIC SOURCE





\* Improvement of energetic content in the last 5 years.

\* Higher energetic value than corn



# A COMPETITIVE CEREAL WITH OTHERS



- Starch content equivalent to Maize
- · Protein content equivalent to « straw cereals »
- → Alternative source



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#### **SMALL SIZE OF GRAINS**





# **IMPORTANCE OF GRINDING IN FACTORY**

- Importance of the grid size to avoid full grains in mash form
- Impact of particles size (optimum 300-700 µm) on animal performances
- Use of whole grain in broiler (10-20%): impact on weight gizzard (Biggs et al, 2009)
- Fine grinding positive for quality pellet → Find optimum

➔ Like other cereals, management of feed process is a key of success with sorghum based diets









#### **ANTINUTRITIONAL FACTORS: A LIMIT?**

- Tanins : Genetic selection : not an issue in Europe, America , Australia, India : use of low tanins varieties
- Mycotoxins: less risk because of drier climates than other cereals (necessity of moisture for fongus development)
- Kafirins: limit starch digestion in ruminants (good against acidosis)
- Lack of xanthophylls: compensated by pigments in layers
- Phytic Acid : Use of phytase in feed to limit negative effects



➔ No limit of using sorghum if well balanced



#### **EFFECTS OF PHYTASE**

Use of phytase limits impact of phytic acid

- Improvement of digestibility AA, P
- Reduce level of Ca (negative effect)
- *E*ffect on broiler grower formula with 37% of sorghum, 1000 FTU/kg phytase





# **EFFECTS OF FEED ENZYMES ON SORGHUM DIETS**

	Poultry	Pigs	Comments
Phytase	++	++	
Xylanase/NSPase	+ / ++	+	+ 1-3% Energy (depends of choice of enzymes)
Protease	++	++	Increase of N retention, not authorised in EU for pigs

Nutritive quality of sorghum can be improved with use of selected enzymes



Economic interests of using sorghum

Sorghum the reliable crop.

# **INTEREST OF NEW RAW MATERIAL IN FEED FACTORY**

#### Example of using Sorghum in plant

- 5 silos for RM in feed factory
- Plant 10 000t / QT
- South of France 'October 2018

• Wheat:	210 €/t
• Corn	190 €/t
<ul> <li>Corn Distillers (DDGS)</li> </ul>	270 €/t
<ul> <li>Soyabean meal (SBM)</li> </ul>	350 €/t
<ul> <li>Sunflower Meal (SFM)</li> </ul>	268 €/t
<ul> <li>Sorghum</li> </ul>	(190) €/t

#### Program Broiler Feed Ross 4 phases

Feed	Age	Quantity (kg)
Starter	0-10d	0.35
Grower 1	11-20d	0.75
Grower 2	21-31d	1
Finisher	32d-slaughter	1.2



# **INTEREST OF NEW RAW MATERIAL IN FEED FACTORY**

#### Example of using Sorghum in plant



# Use of Sorghum → Less use of corn, wheat and SBM



# **INTEREST OF NEW RAW MATERIAL IN FEED FACTORY**

Example of using Sorghum in plant

Feed	Quantity (kg/chick)	Actual (€/t)	With Sorghum (€/t)	Gain (€/t)
Starter	0.35	276.47	274.18	-2.29
Grower 1	0.75	273.05	270.32	-2.73
Grower 2	1	263.14	260.14	-3
Finisher	1.2	252.69	250.03	-2.66
			Average gain	-2.65



# **INTEREST IN PIG FORMULA**

#### Using sorghum : impacts on recipe

#### PIG GROWER NET Energy 9.9 MJ/kg CP 16% Lys av Pig 0.85 % Service Plant : 066 - Formula : 0235.90, Pig Grower File Edit Tools Options Display Go to... 🗋 🔚 💾 🎒 🌍 🌐 📋 🗋 😓 📝 Print settings Heading Formula Rounding 🦂 Run Min % Purchase constraints ● Add to comparator ader lines Formula Active Plant 066 FEED FACTORY France Price list 99 2018 October Number of RM 23 Number of characteristics Price\*Tonn 0.00 Cost diff\*Ton. Total 100.00 Product 100.00 100.00 0.00 Tonnage 232.82 Cost diff. 0.98 Rounded price 232.67 Optim. No AC Price 221 181 Production 221 180 905 05 /2018 Round off Automatic rounding Formula Run Note Prod Composition Rejected RM Characteristics v Interest price Min % 'Production' Code Δ Raw material Prod.... Diff. Min. Avail. 🔻 Price % Max. -25.000 7.27 Sorghum 1 0.01 02078-C66 Corn Distillers DDGS 246.40 2 233.25 04100-C66 Rapeseed Meal 260.0 з 04260-066 Sunflower meal 280.0 254.35 2.77 4 2.00 Sugarbeet Pulp 0.009 175.00 34.26 5 Sugarcane Molasses 204.0 65.19 6 599.49 15010 Rapeseed Oil 1.999 690.0 7 L-Tryptophane 99% 12 040.0 767.72 1.18 17300 8

Sorghum

#### **INTEREST IN PIG FORMULA**

#### Using sorghum : impacts on recipe

		ar oo							1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1							
lant	1a 02	35.90 IT Pig	Grower	rance					Act	ive							
rice l	ist 99	201	8 October	Tarrice		1	🗃 Nui	mber of RM	23 Numbe	er of char	acteristi	cs 25	9				
rice*	Tonn.	0.00 Cost diff*Ton.	Tonnage		Total		10	0.00 'Product	tion' 10	00.00	100.0	10					
rice	2	81.93 Cost diff1.29	Rounded pr	ice	232.67 Optin	n. No	221	181 Product	tion' 22:	L 180	90	05/10/2	2018 AC				
	Formula	Run	Aut	omatic roun	ding	Note	e Prod.										
omp	osition Rejected	RM Characteristics															
	Code	△ Raw material	% ⊽	Diff.	Min.	Max.	Av	Price	Cost/RM 🔻	Cost	From	То	Higher price	Low	Min %	%Price	'Production'
1	0001000-C66	Corn	24.240	-10.760	15.0000	35.00		190.00	46.06				190.90	184.77	1.00	19.86	29.77
2	0001110-C66	Wheat	7.383	-15.196		40.00		200.00	14.77				204.52	199.25	1.00	6.37	28.90
3	0001200-C66	Barley	9.999		9.9990	35.00		205.00	20.50	0.35	7.39	10.28		169.96	1.00	8.84	10.00
4	0001301	Sorghum	25.000	25.000		25.00		190.00	47.50	-0.05	10.91	26.27	194.86		1.00	20.48	
5	0002036-C66	Corn Germs	3.000			3.00		206.00	6.18	-0.06		3.64	211.70		1.00	2.66	3.00
6	0002135-C66	Wheat Bran	9.999	0.934		10.00		145.00	14.50	-0.08	8.96	10.13	153.07		1.00	6.25	8.40
7	0004028-C66	Soyabean Meal	17.289	-0.010	2.0000	100.00		376.00	65.01				385.80	332.44	1.00	28.03	16.90
8	0014000	Limestone	0.577	-0.103		100.00		47.00	0.27				660.77		0.10	0.12	0.70
9	0014010-P	Dicalcium Phosphate P18	0.574	0.133	0.1000	100.00		480.00	2.76				623.85	133.16	0.10	1.19	0.40
10	0014052	Clay : Bentonite	0.500	_	0.5000			180.00	0.90	1.39		0.59		40.89	0.50	0.39	0.50
11	0014201	Sodium Bicarbonate	0.100		0.1000			316.00	0.32	2.55		0.28		60.75	0.10	0.14	0.10
12	0014203	Salt	0.423	-0.007		0.50		113.00	0.48				452.96		0.10	0.21	0.45
13	0017000	DL Méthionine 99%	0.050			100.00		2 370.00	1.19	17.87	0.05	0.45		582.62	0.05	0.51	0.02
14	0017100	Lysine HCl 98% (78% Lysine)	0.290	0.016		100.00		1 380.00	4.01				3 772.51	883.73	0.05	1.73	0.28
15	0017200	L-Thréonine 98%	0.074	-0.005	0.0500	100.00		1 390.00	1.03				5 677.95	581.31	0.05	0.45	0.08
	P551N700	Premix Pig 0.5%	0.500		0.5000	0.50		1 295.00	6.48	12.67	0.50	0.70		28.14	0.50	2.79	0.50





# VARIABILITY OF RAW MATERIALS: AN ISSUE

Formulation: « art » to manage variability of raw materials





# MANAGING THE VARIABILITY

#### Use of an extra raw material

Plant: 066 - Formula: 0235.90, Pig Grower

Plant: 066 - Formula: 0235.90, Pig Grower



#### **MANAGING THE VARIABILITY**

Plant: 066 - Formula: 0235.90, Pig Grower

Plant: 066 - Formula: 0235.90, Pig Grower



Showing respect for our environment. Sorghum

the reliable crop.

#### **ENVIRONMENTAL DATAS**

Use of Ecoalim database

- Database built by INRA and ADEME in 2015
- Evaluation of Life Cycle Analysis (LCA)
- 6 parameters:
  - Phosphorus consumption (g/kg feed)
  - Cumulative energy demand (non-renewable: fossil + nuclear): MJ/kg feed
  - Climate change (Greenhouse gas emission in g CO2eq / kg feed)
  - Acidification (mol H+ / kg feed)
  - Eutrophication (PO<sub>4</sub><sup>3-</sup> equivalent per kg of product)
  - Land Competition (m<sup>2</sup> per year per kg of product)

160 datas for approximatively 50 feed evaluated



# **DATAS ON CEREALS**



Sorghum: cereal with low impact in climate change and acidification of soils, in european conditions



# **IMPACT ON FEED ENVIRONMENTAL IMPACT**

#### PIG GROWER FORMULA

🥧 Plan	nt : 066 - I	Formula : 02	35.90, Pig Gro	wer - Comparison	with roun	ded diet				
File										
90	Set	tings Sen	siti <mark>v</mark> ity (%)	10.00 % 🗲 🛛	-					
Refer	ence Die	t								
Prod. N	10	905	Opt. No	221 180						
Update	0	5/10/2018	User	AC						
Note										
	1	Code		Price list		Current opt	im.	Production	Diff.	
1	99		2018 Octob	er		23	1.87	232.67	-0.7	9
Comp	osition	Characteri	stics							
		Code △		Raw material		Current optim.	Proc	luction	Diff.	
1	0001000-C66 Corn			10.00		29.77	-19.77			
2	2 0001110-C66 Wheat			24.53		28.90	-4.37			
з	3 0001200-C66 Barley			10.00		10.00	0.00			
4	0001301 Sorghum			25.00			25.00			
5	0002036-C66 Corn Germs			3.00		3.00				
6	0002135	i-C66	Wheat Bran			8.38		8,40	-0.02	
7	0004028	I-C66	Soyabean M	eal		16.00		16.90	-0.90	
8	0014000	la series de la companya de la comp	Limestone			0.65		0.70	-0.05	
9	Dicalcium Phosphate P18			0.48		0.40	0.08			
10	10 0014052 Clay : Bentonite			0.50		0.50				
11	11 0014201 Sodium Bicarbonate			0.10		0.10				
12	12 0014203 Salt			0.42		0.45	-0.03			
13	0017000		DL Méthioni	ne 99%		0.04		0.02	0.02	
14	0017100		Lysine HCl 9	8% (78% Lysine)		0.32		0.28	0.04	
15	0017200		L-Thréonine	98%		0.09		0.08	0.01	
	16 P551N700 Premix Pig 0.5%					0.50		0.50		



#### Use of sorghum in pig formula contributes to improve environmental impact of feed



# AND AFTER...

Which rates of using sorghum in diets?

Feed	Actual maximum rate	Up to
Broiler	35%	60%?
Layer	25%	50%?
Pig	50%	80%?
Ruminant	30%	50%?
Rabbit	20%	50%?
Fish	50%	



Importance to continue (start?) using sorghum and increase rates of inclusion in order to complete knowledge and remove negative ideas.

Complete knowledge to improve trust of feed nutritionists



# CONCLUSION

No specific reason not to use sorghum

- Think as an opportunity as energetic source
- Way of diversification raw material (reducing variability of feed)
- Can be used in all species
- Limited risk of mycotoxin contamination
- Economic interest in feed factories
- Way to limit proteic dependancy
- Way of improving environmental impact of feed



