# Oats as Feed for Pigs and Poultry

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#### Grains = Carbohydrates = Energy



#### Not all carbohydrates created equal



FIGURE 4-4 Categories of dietary carbohydrates based on current analytical methods.

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## Feed Trough Plant Carbohyrates

- 1. Starch
- Things that are not starch... aka Nonstarch Polysaccharides (NSP)

## Grains = Carbohydrates = Energy

- Starch... readily digested by mammalian enzymes
- Nonstarch polysaccharides = Fiber...
   only digested by microbes



### Quantifying Fiber

Neutral Detergent Fiber (NDF) hemicellulose + cellulose + lignin Acid Detergent Fiber (ADF) cellulose + lignin NDF  $\rightarrow$  gut fill  $ADF \rightarrow digestibility$ 

#### Feed Grains for Pigs<sup>1</sup>

	Starch, %	NDF %	ADF, %	NE, MJ/kg
Corn Grain	74	12	3	12.8
Wheat, SRW <sup>2</sup>	70	14	4	12.1
Rye	62	16	4	11.3
Barley	60	22	6	11.0
Whole Oats	41	37	17	9.1

<sup>1</sup> Based on Sauvant et al 2002. All values on dry matter basis
 <sup>2</sup> Soft Red Winter (grown in humid Midwest)

#### Starch vs Fiber for Nonruminants

- More Starch = Less Fiber
- More starch = More energy dense
- More Fiber = Less energy dense

	Starch, %	NDF %	ADF, %	NE, MJ/kg
Corn Grain	74	12	3	12.84
Wheat, SRW <sup>2</sup>	70	14	4	12.1
Rye	62	16	4	11.3
Barley	60	22	6	11.0
Whole Oats	41	37	17	9.1

## Impact of ADF on pig growth

- 15 pens of pigs, 8 week trial (165-290 lb)
- Fed 1 of 3 diets:
- 1. Corn-Soybean Meal4.4% ADF
- 2. Corn-SBM + 20% Wheat Middlings 4.7%
- 3. Corn-SBM + 20% Oat Screenings

4.7% ADF 8.5% ADF

Lammers and Honeyman 2017 doi:10.2527asasmw.2017.12.198

#### Average Daily Gain (lb/d)



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#### Gain : Feed (lb of gain + lb of feed)



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#### Take Home Message...

 Slight increases in ADF (5-7%) can maintain performance

• Larger increases in ADF will reduce growth rate and require more feed



https://nlmstudio.wordpress.com/port folio/whats-time-to-a-pig/

Nancy Lehenbauer Marshall

#### Reduced growth rate

More time in the barn OR
Smaller pig to market



Impact of 2.5 vs 2.0 ADG in 165–290 lb pigs



± 14 days to reach market weight... impact really depends on facility cost OR

# ± 30 lb live weight ~ 22 lb carcass wt \$15-17 in value at current prices

(\$71/cwt carcass weighted average https://www.ams.usda.gov/mnreports/lsddhps.pdf)

# Oats for Growing Pigs without Sacrificing Performance

- 15% total diet for 25 lb pig
- 30% total diet for 25–50 lb
- 35% total diet for 50-125
- 40% total diet for >125—
   replace ~45% of corn in diet



Can we replace all corn in a pig diet with oats???? Yes but...

- 1. Pigs will grow slower
- 2. Pigs will eat more feed



The fibrous hull is a challenge

#### Oats - Oat Hulls = Oat Groats







	Starch,	NDF	ADF,	NE,
	%	%	%	MJ/kg
Corn Grain	74	12	3	12.84
Wheat, SRW <sup>2</sup>	70	14	4	12.1
Rye	62	16	4	11.3
Barley	60	22	6	11.0
Whole Oats	41	37	17	9.1
Oat Groats	61	14	5	11.7

<sup>1</sup> Based on Sauvant et al 2002. All values on dry matter basis
 <sup>2</sup> Soft Red Winter (grown in humid Midwest)

#### Oats - Oat Hulls = Oat Groats







Remove the hull and there really is not a nutritional limit on feeding oats to pigs

### What about poultry????

- 20-40% of total diet without sacrificing performance
- Higher rates possible with enzyme supplementation (Beta glucanase)

#### **Beta Glucans**

- Relatively high in oats
- Reduce digestibility of starch and protein



FIGURE 4-4 Categories of dietary carbohydrates based on current analytical methods.

Enzymes (from fungi) reduce impact

# Oats for Pigs and Poultry

We can feed oats to pigs and poultry

 Market price usually disfavors— \$0.15/lb corn vs \$0.26/lb oats

 If you grow oats you can definitely feed them effectively!

#### Corn vs Oat using WI yield data

- Corn 172 bu/acre (9,632 lb/acre)
- Oat 65 bu/acre (2,080 lb/acre)

 If land planted 50-50 corn and oat, we'd need to feed pigs 18% oats

## Corn vs Oat using WI yield data

- Corn 172 bu/acre (9,632 lb/acre)
- Oat 65 bu/acre (2,080 lb/acre)

- If land planted 50-50 corn and oat, we'd need to feed pigs 18% oats
- 60% less grain than with 100% corn

#### **Farming System Resiliency**

Diversity Asecurity in face of uncertainty

... enhances nutrient cycling

... another tool to manage pests and weeds ... spreads field work out over longer period



# Oat Variety—does it matter?



# YES! Not all oats are equal under all conditions...



#### Practical Farmers of Iowa and Iowa State University Oat Variety Trials

- Multiple locations
- Multiple years
- Multiple varieties
- Primarily focused on agronomy...

https://practicalfarmers.org/research/

# Oat Variety Work

- Location impacts yield and test weight
- Growing season impacts yields and test weight
- Different varieties excel under different conditions

#### But what about the nutritive value of the oats?????

#### **Nutrient Profile of Oat Varieties**

- 2016–2018
- 23 different varieties
- 125 individual samples analyzed using NIR

#### **NIR Near Infrared Reflectance**



#### https://www.thermofisher.com

#### **Near Infrared Reflectance**

- Does not destroy the sample
- Little to no sample preparation
- Results in seconds
- 25% of the cost of wet chemistry

#### **Oat Variety Distribution**





#### No clear relationship between Starch and Protein



Higher starch content associated with lower Fiber Content

Textbook example of an inverse relationship aka negative correlation 32 lb bu/ac vs. Starch



More starch not always associated with larger yields...

Table 1. Least squares means values and standard error obtained linear mixed model using proc mixed option in SAS.							
Variety	Starch	SE	aNDFom	SE	СР	SE	
Antigo	38b	1.4	27.4a	1.6	13.3	0.6	
Badger	47.4a	1.8	21.4ab	1.9	13.1	0.7	
Betagene	44.2ab	1.1	24.5ab	1.4	12.6	0.6	
Camden	43.1ab	1.6	25.1ab	1.7	12.2	0.7	
Deon	44.8ab	1.1	23.3ab	1.4	12.3	0.6	
Esker	46.5ab	1.6	23ab	1.7	13.6	0.7	
Excel	47.3ab	1.8	22.3ab	1.9	12.4	0.7	
Goliath	46.2ab	1.6	22.9ab	1.7	12.2	0.7	
Hayden	42.7ab	1.2	25.9ab	1.4	12.0	0.6	
Horsepower	43.3ab	1.1	25.2ab	1.4	12.5	0.6	
Jerry	42.8ab	1.1	24.8ab	1.4	12.6	0.6	
Leggett	47.2ab	1.6	22.3ab	1.7	11.9	0.7	
Pearl	47.9a	1.6	19.1b	1.7	12.5	0.7	
Natty	48.2a	1.1	20.9ab	1.4	12.4	0.6	
Reins	46ab	1.1	22.3ab	1.4	12.9	0.6	
Rockford	42.6ab	1.6	24.9ab	1.7	12.5	0.7	
Ron	42.1ab	1.6	24.5ab	1.7	13.7	0.7	
Saber	45.6ab	1.1	22.6ab	1.4	13.1	0.6	
Saddle	48.8a	1.6	19.6ab	1.7	12.8	0.7	
Shelby	44.4ab	1.1	22.4ab	1.4	13.2	0.6	
Souris	46.7ab	1.6	23.9ab	1.7	11.4	0.7	
Sumo	47.7a	1.4	20.1ab	1.6	13.6	0.6	
Tack	45ab	3.1	22.2ab	2.7	12.4	1.1	
P-value	0.0111		0.0096		0.1774		

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 Variety	% Starch	% aNDFom
Antigo	<mark>38b</mark>	<mark>27.4a</mark>
Badger	<mark>47.4a</mark>	21.4ab
Betagene	44.2ab	24.5ab
Camden	43.1ab	25.1ab
Deon	44.8ab	23.3ab
Esker	46.5ab	23ab
Excel	47.3ab	22.3ab
Goliath	46.2ab	22.9ab
Hayden	42.7ab	25.9ab
Horsepower	43.3ab	25.2ab
Jerry	42.8ab	24.8ab
Leggett	47.2ab	22.3ab
Pearl	47.9a	<mark>19.1b</mark>
Natty	<mark>48.2a</mark>	20.9ab
Reins	46ab	22.3ab
Rockford	42.6ab	24.9ab
Ron	42.1ab	24.5ab
Saber	45.6ab	22.6ab
Saddle	48.8a	19.6ab
Shelby	44.4ab	22.4ab
Souris	46.7ab	23.9ab
Sumo	<mark>47.7a</mark>	20.1ab
Tack	45ab	22.2ab
P-value	0.0111	0.0096

## Preliminary Work

 Badger, Pearl, Natty, Saddle, and Sumo have higher starch content than Antigo

Antigo has higher fiber than Pearl

• Analysis continues...

# Oat Variety Work

- No obviously superior variety in terms of agronomy or feeding value
- May want to add starch content to yield and test weight as selection parameters

#### Take Home Points

- Starch and fiber inversely related in grain
- (some) Oats can be fed to livestock without impacting performance
- Regularly quantifying nutrient profile of feed can help explain livestock performance