Alternatives to Corn and Soybeans

How to safely use the other grains and proteins.

The Value of What's Being Replaced

- Corn
  - 7 – 9% Protein
  - 1475 – 1600 kilocalories per pound
  - Xanthophylls (yellow color) for yolk and body color
  - Available almost everywhere
  - Cheap!

- Soybeans
  - 36 – 48% protein
  - 1050 (48% meal) – 1600 (Full fat roasted) kilocalories per pound
  - 16 – 20% Fat – natural oils that provide non-starch energy.
  - Soybean meal is available almost everywhere.
  - Cheapest source of protein!

Alternative Grains

- Energy alternative sources for Corn
  - Wheat
  - Barley
  - Grain Sorghum (Milo)
  - Triticale
- Protein alternative sources for Soy
  - Peas
  - Sunflower meal
  - Linseed (flax) Meal
  - Camelina Meal
  - Fish Meal
  - Crab Meal
  - Sesame Meal

The Real Questions

- Why are corn and soy used in feeds?
- Are there really good alternatives?
- Does using alternative ingredients adversely effect the complete feed?
- Will the animals attain the same results?
- How does the cost compare?

Alternatives to Corn

Grain Sorghum (Milo)
Wheat
Barley
Triticale

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Grain Sorghum (Milo)

- 7-9% protein, 1400 Kcal/lb
- The most suitable replacement for corn.
- Feeding value is essentially 95–96% the same as corn
- Limitation: tannin content
  - The red or rusty color of the seed = higher tannins
  - White or light varieties are have less tannins which allows feeding higher levels
- Should be limited to 30-40% of the total diet *based on tannin content*

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Wheat

- 9-16% protein, 1440 kcal/lb
- Hard, red spring wheat varieties tend to have higher protein
- Soft, white winter varieties lower protein
- Limitations: Pentosans content and the lack of Xylanase enzymes produced by the poultry digestive tract
- Diets should be limited to 30% for young poultry and 50% for mature poultry

Hard Red Spring Wheat

Soft White winter Wheat

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Triticale

- 11-13% protein, 1400 kcal/lb
- Hybrid of wheat and rye
- Limitations: Pentosans content and the lack of Xylanase enzymes produced by the poultry digestive tract
  - Similar to wheat
- Diets should be limited to 30% for young poultry and 50% for mature poultry

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Barley

- 11-12% protein, 1250 kcal/lb
- Limitations: are due to *β-Glucan* content of barley, 5-8%
- Should be limited to 15 – 20% of the diet
- May be fed at higher levels if *β-Glucanase* enzymes are added to the diet

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Oats

- 10-12% protein, 1100 kcal/lb
- Limitations are due to *β-Glucan* content of oats, 5-8%
- Should be limited to 15 – 20% of the diet
- May be fed at higher levels if *β-Glucanase* enzymes are added to the diet

Alternatives to Soy

- Peas
- Fish Meal
- Linseed Meal
- Sunflower Meal
- Camelina Meal
- Crab Meal
- Sesame Meal
- No-Soy Protein Blend

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Peas (Field, Cow, Cull)

- 22 – 24% CP, 1300 kcal/lb average energy
- Limitations:
  - Low Sulfur Amino Acids
  - Tannins- higher tannin varieties will reduce protein digestibility
    - 6% reduction for every 1% of tannins
- Limited to 20 – 25% in most poultry diets

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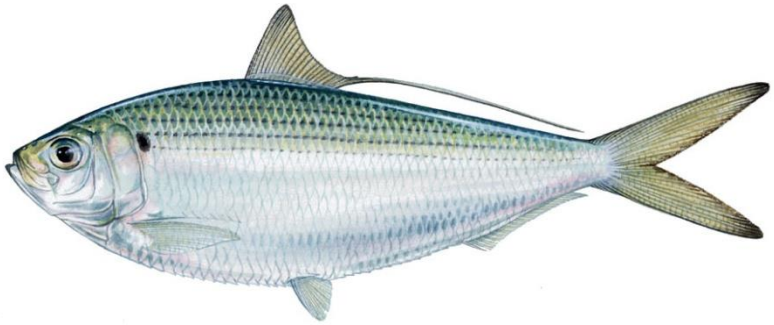
Fish Meal

- 58 – 72% protein, 1280 – 1550 kcal/lb
- Limitations to feeding
  - High oil varieties-Herring, Menhaden and Anchovies may cause off flavoring due to the fish oil
- High oil meals, should not exceed 5% of the ration
- Low oil varieties-Catfish meal, comes from farm raised catfish. May contain higher levels contaminants, antibiotics or heavy metals

Menhaden



Herring

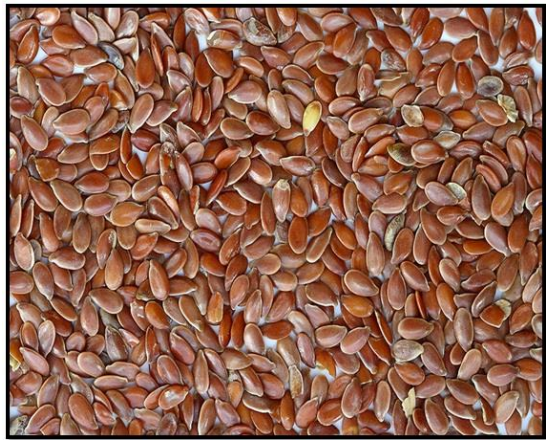
Anchovies

Catfish

3

Linseed (Flax) Meal

- 30-37% protein, 1100-1300 Kcal/lb
- Generally only used in ruminant feed. *If kept fresh* and not oxidized, works well in poultry and swine feeds.
- Limitations: off flavoring
  - Fish flavor or a paint like smell from the high oil content at levels above 30%
- Can fed up to 20% of the diet safely without off flavoring
- Use caution in combination with fishmeals and other high Omega 3 oils!



4

Sunflower Meal

- 34-38% CP, 1000 – 1100 Kcal/lb
- By product of the oil seed industry
- Limiting concerns: highly oxidative and very high non digestible fiber
- When fresh, can be used up to 10 -15% of the diet

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Camelina Meal

- 37% CP, 1510 Kcal/lb
- Byproduct of the oil seed industry
- It has the protein and energy of roasted soybeans after the oil has been removed
- Limited by the FDA to not exceed 10% of Layer and Broiler diets, 2% for swine
- So far, does not appear to oxidize quickly and cause feed refusal

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Crab Meal

- 30-36% CP, 900-1100 kcal/lb
- Byproduct of the food industry
- Limitations: high salt, low energy
  - Usually between 2-3 salt from natural sources
- Very low availability in most areas

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Sesame Meal

- 42% CP, 1025kcal/lb ME
- Similar amino acid profile to soybean meal
  - Lower lysine, higher methionine
  - Low in isoleucine, leucine
- Byproduct of oil see industry
- Limitations: Phytic acid, which inhibits calcium absorption
- Up to 10-12% of broiler diet
- 15% of grower/finisher pigs

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No-Soy Protein Blend

- 34% CP
- Blend of 5 different protein sources
- Limitations: none

Protein Sources Comparison Charts

- *Niche and Organic Chicken Products*
- *SH Gordon & DR Charles*
- *Nottingham University Press, Nottingham, NG11 0AX, United Kingdom,* ISBN: 1-897676-96-4

Table 4: Antinutritional Factors in Alternative Protein Sources

Protein Source	Antinutritional Factors	Possible Palliatives	References
Soya	Protease inhibitors, lectins, antigenic proteins, alkaloids	Heat treatment	van Kempen & Jansman (1994), Huisman & Tolman (1992)
Peas	Protease inhibitors, lectins, pectins, phenolics, tannins, haemmagglutinins	Micronisation	Igbasan & Guenter (1996), Igbasan & Guenter (1997), Huisman & Tolman (1992), Castell et al., (1996)
Lupins	Alkaloids, raffinose oligosaccharides, pectins, α-galactosides	Sweet Lupins spp.	Olver & Jonker (1997), van Kempen & Jansman (1994), Huisman & Tolman (1992)
Beans	Tannins, trypsin inhibitor, lectins, phenolics, vicine/covicine	Heat treatment	Canstanon & Perez-Lanzac (1990), Huisman & Tolman (1992),
Sunflower	Trypsin Inhibitors, phenolics, phytates, chlorogenic acid, quinic acid		Huisman & Tolman (1992), van Kempen & Jansman (1994)
Rapeseed	Glucosinolates, phenolics, tannins, phytic acid, pectins, sinapines, euric acid	Low glucosinolate varieties	Khattak et al., (1996), van Kempen & Jansman (1994), Huisman & Tolman (1992), McDonald et al., (1995)
Linseed	Vitamin B6 antagonist, trypsin inhibitor, cyanogenic glucoside		van Kempen & Jansman (1994)

Table 5: Some Published Suggested Maximums inclusion rates of various Vegetable Protein Sources

Protein Source	Broiler Feeds	Layer Feeds	References
Peas	25% - 30%	15%-20%, 30% for better egg taste	UNIP-ITCF (1995)
	5% to week 4, 10% after week 4	10%	Leeson & Summers (1997)
		10%	Larbier & Laclercq (1992)
		30%	Castanon & Perez-Lanzac (1990)
		20%	Igbasan & Guinter (1997b)
Lupins	5%	10%	McDonald *et al*., (1995)
	8% to week 4, 10% after week 4	15%	Leeson & Summers (1997)
		20%	Castanon & Perez-Lanzac (1990)
Beans		10%	Larbier & Laclercq (1992)
	30%		Jansman *et al*., (1993)
Sunflower	8% to week 4, 10% after week 4	10%	McDonald et al., (1995)
		15%	Leeson & Summers (1997)
Rapeseed	5%		McDonald et al., (1995)
	10% (double 00 varieties)	10%(double 00 varieties: white layers only)	van Kempen & Jansman (1994)
	5% in Starter 8% in Finisher		Leeson & Summers (1997)

Table 3: Example of Vitamin Contents of Full Fat Soya, Wheat and Peas, for Comparison

Vitamin	Units	Full Fat Soya	Wheat	Peas
Vitamin E	mg/kg	40	13	1
Pantothenic Acid	mg/kg	10	12	11
Niacin	mg/kg	15	55	37
Choline equivalent	mg/kg	2174	2200	668
Riboflavin (B2)	mg/kg	2.4	1.1	2.2
Thiamin (B1)	mg/kg	1.8	4.8	7.4
Biotin	mg/kg	0.31	0.11	0.16
Folic Acid	mg/kg	0.53	0.4	0.3
Vitamin A activity	10^3 iu/kg	3.2	0	0

(Based on Leeson & Summers, 1997)

Presentation

Ration Type: 19.8%

Broiler Ration-No Soy

Ingredients:	LBS
Aragonite	25.0
Camelina	200
Corn, medium ground	690
Crab Meal	150
Fish meal,64%	100
Linseed (Flax) Meal, expelled	300
Oil, vegetable	75
Peas, Field	200
Poultry Nutri-Balancer	60
Wheat, 12%	200
Total	2000

Nutrient Name:	Amount	Units
Crude Protein	19.8%	%
Crude Fat	7.2%	%
Crude Fiber	5.2%	%
Calcium	2.38%	%
Phosphorus	1.00%	%
Salt added	0.70%	%
Sodium	0.26%	%
Energy	1,235	Kcal/LB
Vitamin A	4723	IU/LB
Vitamin D	1608	IU/LB
Vitamin E	50	IU/LB
Choline	1521	IU/LB
Biotin	45.2	MCG/LB
Manganese	147.8	IU/LB
Zinc	93.2	IU/LB
Copper	15.86	IU/LB
Selenium (added)	0.30	IU/LB
Lysine	0.88%	%
Methionine	0.49%	%
Methionine/Cystine	0.67%	%
Arginine	1.26%	%

Presentation

Ration Type: 16.2%

Layer Ration-No Soy

Ingredients:	LBS
Aragonite	150.0
Camelina	200
Corn, medium ground	790
Crab Meal	100
Fish meal,64%	50
Linseed (Flax) Meal, expelled	200
Oil, vegetable	50
Peas, Field	200
Poultry Nutri-Balancer	60
Wheat, 12%	200
Total	2000

Nutrient Name:	Amount	Units
Crude Protein	16.2%	%
Crude Fat	5.7%	%
Crude Fiber	4.7%	%
Calcium	4.24%	%
Phosphorus	0.91%	%
Salt added	0.59%	%
Sodium	0.23%	%
Energy	1,177	Kcal/LB
Vitamin A	4761	IU/LB
Vitamin D	1608	IU/LB
Vitamin E	50	IU/LB
Choline	1521	IU/LB
Biotin	45.9	MCG/LB
Manganese	147.5	IU/LB
Zinc	89.3	IU/LB
Copper	14.32	IU/LB
Selenium (added)	0.30	IU/LB
Lysine	0.67%	%
Methionine	0.40%	%
Methionine/Cystine	0.55%	%
Arginine	1.04%	%

The Real Questions

- How important is it to use Corn and Soy in feed?
- Are there really good alternatives?
- Does using alternative ingredients adversely effect the complete feed?
- Will the animals attain the same results?
- How does the cost compare?

Questions?

THANK YOU!

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