

Catfish Nutrition: Feeds

Since cultured catfish get only a small portion of their food nutrients naturally, they must be fed a complete feed. That is, one formulated to provide all required nutrients in the proper proportions necessary for rapid weight gain, high feed efficiency, and a desirable composition of gain (high protein gain and low fat gain).

Feed cost is about half of variable production costs in catfish culture, so as a catfish producer, you should carefully consider feed selection and use.

Feed Ingredients

No one feed ingredient can supply all of the nutrients and energy catfish need for best growth. Commercial catfish feeds contain a mixture of feedstuffs and vitamin and mineral premixes that provide the right essential nutrients as well as the energy necessary to use the nutrients. The amount of each feed ingredient depends on several factors, including nutrient requirements, ingredient cost, availability of each ingredient, and processing characteristics.

Protein and Energy Supplements

Feedstuffs containing 20 percent crude protein or more are considered protein supplements. Protein supplements may be classified as animal or plant proteins. Animal proteins used in animal feeds come from inedible tissues from meat packing or rendering plants, milk products, and marine sources. Those used in catfish feed include marine fish meals, catfish offal meal, meat and bone/blood meal, and poultry byproduct meal.

Animal proteins are generally considered to be higher quality than plant proteins. Animal protein is essential in the diet of fry and small fingerling catfish. Fish meal prepared from whole fish appears to be a better protein supplement than other animal proteins. But fish meal does not appear to be essential in the diet of catfish after they reach a size of 6 to 7 inches. Animal proteins can be replaced by plant proteins in catfish food fish feeds without affecting growth and feed efficiency.

The main plant protein sources used in catfish feeds are oilseed meals, such as soybean meal, cottonseed meal, and peanut meal. Some other oilseed meals could be used but are not generally available on a timely basis and at an economical cost per unit of protein. A brief description of various animal and plant protein sources that can be used in catfish feeds is given in the chart on the next page.

Energy supplements are feedstuffs that contain less than 20 percent crude protein. They include grain and grain byproducts and animal fat or vegetable oil. It is important to include nonprotein energy sources in catfish diets because they are the most economical source of energy, and they prevent dietary protein from being used for energy. Energy sources typically used in commercial catfish feeds include corn, corn screenings, wheat grain, wheat middlings, rice bran, milo, animal fat, and fish oil (see the chart on the next page).

Feedstuffs used in commercial catfish feeds.

Feed ingredient	Dry matter	Crude protein	Selected characteristics (%)				Comments
			Crude fat	Crude fiber	Lys	Met + Cys	
<i>Protein Supplements</i>							
Soybean meal <i>(dehulled, solvent-extracted)</i>	89.3	48	1	3	3.2	1.5	Major protein source used. A high quality ingredient. Contains antinutritional factors that are destroyed by heating. Tasty to catfish.
Cottonseed meal <i>(direct solvent-extracted)</i>	90.4	41	2.1	11.3	1.76	1.1	Used sparingly. About 10%–15% is generally used. Higher levels can be used if supplemented with lysine. Tasty to cat fish. Contains free gossypol, which can be toxic to catfish at high levels. Lacks lysine; lysine availability reduced by binding to free gossypol.
Peanut meal <i>(mechanically-extracted)</i>	91.8	45	5	12	1.55	1.1	Deficient in lysine. Levels restricted to about 15%–20% without lysine supplementation.
Fish meal^a <i>(Menhaden)</i>	92	62	10.2	1	4.7	2.4	Good source of needed amino acids, phosphorus, and digestible energy. May also provide essential fatty acids. Tasty to catfish. Grow-out feeds for catfish generally contain 2%–4% fish meal.
Meat and bone meal^b	92.6	50	8.5	2.8	2.6	1.0	Good source of calcium and phosphorus. High in ash, which limits its use somewhat because of possibility of mineral imbalances. Maximum level recommended for catfish feeds is 15%. ^b
Blood meal^b	91	85	1	1	6.9	1.6	Flash or spray-dried blood meal have been used. Excellent source of lysine but lacks methionine. Up to 5% can be used as lysine supplement. Generally used in combination with meat meals. ^b
Catfish offal meal	90	58	11	–	4.19	1.9	Prepared from catfish processing waste. Good source of calcium, phosphorus, and energy. Its use depends on availability.
Poultry byproduct	94	58	14	2.5	2.57	2.04	Prepared from ground, rendered, or clean parts of meal the carcass of slaughtered poultry. It is marginal in lysine. Its use depends on availability and cost.
Hydrolyzed feather meal	93	85	2.5	1.5	1.05	3.55	Prepared by the high-pressure treatment of clean, undecomposed feathers from slaughtered poultry. It is high in methionine and cystine but severely deficient in lysine. It is rarely used in catfish feed.
Canola meal	91	38	3.8	11.1	2.3	1.2	Prepared from a special rapeseed that is low in glucosinolates and erucic acid, toxic compounds to animals. Slightly low in lysine. It is tasty to catfish and can be used at levels up to about 35% in catfish feeds without harmful effects.
Distiller's grains	91	29	8.4	7.8	0.81	0.98	Prepared from residuals after removal of the alcohol by distillation from the yeast fermentation of cereal grains. Low in lysine. It is tasty to catfish and can be used at levels up to about 35% in catfish feeds without adding lysine.

Full-fat soybeans	90	38	18	5	2.4	1.1	Rarely used in catfish feeds, mainly because of high fat content. Some can be used as long as total fat level in feed is not more than about 6%.
<i>Energy supplements</i>							
Corn grain^c (yellow)	88	8.9	3.5	2.9	0.22	0.3	Abundant and relatively inexpensive source of energy. Cooking improves energy digestibility. Aids in pelleting and improves floatability of feed.
Wheat gain	88	13.5	1.9	3	0.4	0.6	Generally used sparingly in catfish feeds because corn is less expensive. Is used at rate of 3%–4% to improve binding of feed pellet.
Wheat middlings	89	17.7	3.6	7	0.6	0.3	Used at levels up to 15%–30% in some catfish feeds. Improves pellet binding. Nutritional value to catfish as good or better than corn and wheat grain.
Rice bran	91	13.5	12.5	13	0.5	0.3	Used at low levels (3%–5%) because of high fat and fiber levels.
Corn gluten feed	88	21	2.0	10	0.6	1.0	It is the part of corn remaining after taking out most of the starch, germ, and gluten. Up to 50% can be used in catfish feeds without harm.
Catfish oil	–	–	100	–	–	–	Fat extracted from processing waste. About 1 to 2% is sprayed on top of finished feed. Good energy source and used to reduce feed dust.
Fish oil	–	–	100	–	–	–	Good source of essential fatty acids and energy. Also used to reduce feed dust by spraying on finished feed pellet. Used at a rate of less than 2%. Higher levels may reduce survival of fish exposed to ESC or make catfish taste “fishy.”
Fat	99.5	–	99.4	–	–	–	Generally highly digestible. May not supply essential fatty acids. Spray on top of finished feed at rate of 1 to 2% to reduce feed dust.

a Other fish meals may be used.

b Meat and bone meal and blood meal from ruminant animals are not recommended because of the perception of “mad cow” disease.

c Corn screenings and corn gain are often used interchangeably.

d If processed milo is used as a binder, it has nutritive value of milo grain.

Premixes

Vitamin and mineral premixes are generally added to catfish feeds. They provide more vitamins and minerals than what is needed for growth to make up for any losses that may occur during feed manufacture or storage. They are made from high quality ingredients, using forms of vitamins and minerals catfish can readily digest.

Feed Formulation

Catfish feeds have generally been based on a fixed formula with little use of a least-cost approach as is used in other animal industries. To use a least-cost computer program to formulate feeds, manufacturers must know

the cost of feed ingredients, the nutrient concentrations in feedstuffs, nutrient requirements and nutrient availability from feedstuffs, and nutritional and nonnutritional restrictions. Use of least-cost feed formulation is limited because we don’t know much about the nutrient levels that bring maximum profit in relation to levels that result in best weight gain, we can’t store large number of different ingredients at the feed mills, and getting a wide assortment of feedstuffs on a timely basis is a problem. But we can use a simple application of least-cost feed formulation used to formulate catfish feeds. Here are some examples of restrictions placed on nutrients and feed ingredients for least-cost formulation of catfish feeds.

Restrictions for least-cost formulation of a 28% protein feed for catfish.

Item	Restriction	Amount	Unit
Crude protein	Minimum	28.0	%
Crude fiber	Maximum	7.0	%
Lipid	Maximum	6.0	%
Available phosphorus	Minimum	0.30	%
Available phosphorus	Maximum	0.40	%
Digestible energy	Minimum	2.8	kcal/g
Digestible energy	Maximum	3.0	kcal/g
Available lysine	Minimum	1.43	%
Available methionine	Minimum	0.26	%
Available methionine + cystine	Minimum	0.65	%
Grain or grain by-products	Minimum	25.0	%
Cottonseed meal ^a	Maximum	15.0	%
Whole fish meal	Maximum	3.0	%
Non-fish animal protein ^b	Maximum	3.0	%
Xanthophylls	Maximum	11.0	ppm
Vitamin premix ^c	Include		
Trace mineral premix ^c	Include		

a Higher levels may be used if supplemental lysine is used.

b Beef products are not recommended because of its implication of "mad cow" disease.

c Meet dietary allowances for catfish.

Feed Manufacturing

Feed manufacturing puts mixtures of feedstuffs and feed additives into a usable form. The main goal in making feedstuffs is to increase profits of animal production by increasing the nutritional value of the feedstuff or a mixture of feedstuffs. Depending on the animal species, this process may range from a simple reduction of particle size to forming feed pellets through steam pelleting or extrusion. Catfish feeds are unique compared to feeds used for terrestrial animals grown for food because catfish feeds must be pelleted, water stable, and generally made to float on the water surface. Thus most commercial catfish feeds are manufactured by extrusion. If a particular feed additive will not withstand extrusion, the feed may be manufactured by steam pelleting into a sinking pellet. Fat is typically sprayed on the feed pellets before shipping to reduce feed dust ("fines").

Catfish Feeds

Catfish feeds provide all the nutrients catfish need in a highly digestible form. Several feedmills manufacture catfish feeds. Commercial catfish feeds are similar in composition, are of high quality, and provide for rapid, efficient growth. Following are some examples.

Examples of feed formulations used to culture catfish.

Ingredient	% of feed						
	Fry feed (50%) ^a	Fingerling feed (35%)	Food fish feed				
			(32%)	(32%)	(28%)	(28%)	(26%)
Soybean meal (48%) ^a	–	44.2	41.6	47.0	30.1	35.4	28.3
Cottonseed meal (41%)	–	10.0	10.0	10.0	10.0	10.0	5.0
Menhaden meal (61%)	74.2	8.0	4.0	–	4.0	–	4.0
Corn grain	–	27.6	32.1	30.3	33.6	31.9	35.3
Wheat middlings	20.4	7.5	10.0	10.0	20.0	20.0	25.0
Dicalcium phosphate	–	0.5	0.6	1.0	0.6	1.0	0.7
Catfish vitamin mix ^b	include	include	include	include	include	include	include
Catfish mineral mix ^b	include	include	include	include	include	include	include
Fat/oil ^c	5.0	2.0	1.5	1.5	1.5	1.5	1.5

a Values in the parentheses represent percentage protein.

b Commercial mix that meets or exceeds all requirements for channel catfish.

c Sprayed on finished feed pellet to reduce feed dust ("fines").

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