

Gamebirds

Better Nutrition, Better Birds and a Better Bottom Line



Gamebirds

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Introduction



For more than a century, professional wildlife managers, landowners and sportsmen have been stocking gamebirds to establish or increase a resident population. As the popularity of the gamebird production and hunting preserve industries increases, so has the impact on the environment and local economies. Built upon foundations of respect for the land and wise use of renewable resources, these industries provide significant conservation, social and economic benefits.

Preserves protect wildlife and habitat in otherwise shrinking landscapes. Many acres that had been barren of habitat are being restored and replanted for wildlife. Hunting preserves in North America maintain millions of acres, protecting them from development, safeguarding wildlife habitat and keeping the land in the hands of families who have worked it for generations.

The following will provide general management and nutritional information as it relates to the popular gamebird species grown for release on hunting preserves:

- Quail (Bobwhite and Coturnix)
- Ring-necked Pheasant
- Chukar Partridges



No matter which species you produce, your birds' nutrition is important to you. Overall health is determined in large part by meeting any animal's nutritional needs.

To be successful in the gamebird business, you have to remain updated on changes in nutrition and management. To help in these areas, your feed company has joined with others in establishing Cooperative Research Farms (CRF) so that you may benefit from its worldwide feed research.



Gamebird Feed

The Care and Feeding of a Successful Gamebird Operation

Nutrients

Water

The most important nutrient you supply your birds is water, and it is consumed in greater quantity than any other nutrient. Birds will die more quickly from lack of water than with a lack of any of the other nutrients.

Birds should have free and convenient access to water. The amount of water required varies with age, health, ambient temperature and the reproductive status of your birds. Watch for diarrhea or high urinary output, which may be due to high protein or salts intake. A reliable estimate of water needed is 1.7 to 2 times the amount of diet consumed. Therefore, a bird consuming a quarter-pound of feed per day would need up to a half-pound of water.

Water requirements also vary with water quality. Poor quality drinking water is often responsible for less-than-optimum performance. Have your water analyzed at least once a year. Spring is an excellent time for this annual appraisal, as runoff from rains may alter water quality. A change in the level of your water table can result in a change in water quality.

A water suitability analysis is an economical management tool. Table 1. shows the impact of elements analyzed in a water analysis. While not comprehensive, the minerals listed are the more common ones that are most typically of concern.

Table 1. CRF Element Analyses in Water (ppm)

Rating	NO3 Nitrate	Mg Magnesium	Ca Calcium	SO4 Sulfate	Na Sodium	Cl Chloride
No problem	0-45	30	50	75	30	0-70
Chance of problem	45-100	0-60	50-80	75-150	30-50	70-150
Likely problem	100-200	60-90	80-100	150-300	50-150	150-300
Avoid	>200	>90	>200	>300	>150	>300

When minerals are dissolved in water, it becomes able to conduct electricity. By measuring this conductivity, you can calculate the total amount of dissolved solids. This measurement can be expressed in parts per million (ppm) of dissolved solids as a means of measuring water quality.

Table 2. Effects of Total Dissolved Solids

Content of Water (ppm)	Comment
>500	Not recommended for human consumption
<1000	Should present no serious problem
1000-3000	May cause diarrhea
3000-5000	Will cause diarrhea and temporary refusal
>5000	Unfit for birds

Acidity and alkalinity are measured as pH. Values below 7.0 are acid; those above are alkaline. Most water supplies have a value between 6.5 and 8.0. Some producers add acidifiers to reduce the water pH to between 5.5 – 6.0 to improve gut health.

Purity of water refers to the presence (positive) or absence (negative) of bacteria presumed to be coliform. Water positive for coliforms should not be used as a water source without chemical treatment. Drinking water contaminated with coliform bacteria may cause diarrhea and can lead to serious health problems.

Several kinds of water treatments are available to solve various problems. For very high levels of hard water, softening of the water or acidification may be necessary to reduce problems with clogging of watering nipples. There are water-softening devices where sodium replaces calcium and magnesium. Chlorinating will destroy bacteria levels. Filtration will remove some organic and mineral particles. De-ionizing resins remove most of the minerals from the water, but are expensive. Water lines can be a source of lime, slime, rust and algae. They may also be loaded with bacteria, fungi and viruses. Effective cleaning and sanitizing agents are chlorine, iodine and ammonia.

Sampling water requires some preparation. You'll need a clean bottle (sterilized if the water is being checked for purity). Keep the sample cool and transport it to the lab as quickly as possible. Be sure you obtain a representative sample by allowing the water to run before filling your container. For coliform bacteria samples, sterilize the tap with a flame before drawing the water sample. Most labs have special water sample bottles, which simplify the process.

Energy

A constant supply of energy is necessary for all birds to sustain life. Energy for all a bird's systems comes from the feed it eats or body stores.

Fats and oils are the most concentrated sources of energy. On a per-unit-of-weight basis, they have more than twice the energy (calories) than can be derived from a similar amount of carbohydrates or protein. Whether you're seeking to optimize growth or reproductive capability, fat provides readily available energy. Fats and oils provide an essential fatty acid, linoleic acid. Because fats can be applied in a liquid form, there less loss due to fines and dust. There is generally an improvement in palatability with the addition of fat.

Key quality control points your fats-and-oils supplier should be providing:

- Know sources of fat blends and suppliers.
- Know fatty acid structure.
- Determine the total fatty acids and free fatty acids of all fat purchased.
- Monitor moisture, impurities and unsaponifiables.
- Determine peroxide values and AOM frequently.

Carbohydrates are organic compounds composed of Carbon, Hydrogen, and Oxygen (CHO). As they are ¾ of the dry weight of grains, they are a large part of the bird ration. They serve as a source of heat as well as energy in the bird's body. They can be transformed into adipose tissue and stored in the body. The

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insoluble and indigestible CHO from the structural portion of carbohydrates is called fiber. The soluble and digestible CHO portion is labeled nitrogen-free extract (NFE). Glucose is stored in the liver as glycogen; the glycogen then regulates the level of glucose in the blood. Corn and wheat are the key cereals where growing conditions permit successful cultivation. They are primarily an energy source, although they do supply a significant amount of protein.

Key quality control points your carbohydrates supplier should be providing:

- Purchase #2 yellow corn. Monitor moisture levels and store properly.
- Treat with a mold inhibitor when storing high-moisture corn or if there is a high proportion of cracked kernels.
- Check for toxins.
- Adjust energy content by moisture level.
- Adjust crude protein and amino acid levels.

Protein

Protein is digested by a series of hydrolytic enzymes so that its component amino acids can be absorbed from the intestinal tract and used to form body proteins. A large number of the amino acids can be converted to CHO, thereby supplying energy for the body. A few amino acids are ketogenic and form ketones, which also can be used for energy.

Amino acid requirements have been defined for each species, as well as age and function within each species. Protein nutrition has precise amino acids levels, but the ingredients available don't always fit the precise needs of any bird. It is the level of the limiting amino acid which determines how much the bird will have at its disposal for growth, tissue replacement, feathers, eggs and other amino acid-based needs of the body. Another factor in formulating a ration is that the digestibility of amino acids from any ingredient is not 100 percent. Bear in mind, too, that genetic changes cause a change in amino acid requirements. Today, the amount of waste and manure production has become regulated by governmental agencies, and thus excess protein is also a formulation concern.

Soybeans are a key source of high levels of plant protein. They can be processed in different ways. When a significant amount of oil is left in the soybean meal, it can be a potent source of energy for the bird. Key quality control points your plant-protein supplier should be providing:

- Set specifications for all soybean meals.
- Use actual protein and amino acid values in formulation.
- Check for over-processing. Potassium hydroxide is a good measure of protein solubility and there are accurate quick cards, which will provide a urease value.
- Check for flow agents.

Animal proteins help ensure feeds meet your flock's amino acid requirements. Key quality control points your animal-protein supplier should be providing:

- Identify processing type and animal source by supplier.
- Use an antioxidant.
- Monitor crude protein and amino acid contents by supplier.
- Monitor phosphorus, calcium and sodium levels.
- Run occasional peroxide values and AOM tests to check storage.

Minerals

Macro-minerals are defined as those inorganic elements required by the bird as a percentage of the diet. Calcium and phosphorus are required for the skeleton. Sodium, potassium and chloride help maintain the osmotic and pH relationships in the body.

Trace minerals are listed in terms of parts per million (ppm) and function within the body processes. CRF poultry research has worked out digestibility and interaction data among the inorganic elements. Here again, environmental factors indicate that excretion of excess or indigestible minerals, such as phosphorus, copper and zinc can have a negative effect on the environment.

Vitamins

Vitamins are organic compounds which are essential for health, growth and maintenance of the body. While they are needed only in minute amounts, they are a vital part of a bird's diet and must be supplied in the diet to avoid a deficiency, disease or metabolic syndrome. There are a number of substances and conditions—including mycotoxins, cocci and organisms, which cause enteritis, which can interfere with vitamin absorption and therefore result in a "vitamin deficiency".

Fiber

Fiber is a key nutrient for gamebirds. It has a positive effect on the bird's digestive tract by improving nutrient absorption. Excellent fiber sources include alfalfa meal, soybean hulls, and by-products such as wheat midds.

Ingredient Quality Control

By having quality control standards, your CRF member can provide greater control over your return on investment. However, it will take a commitment of finances and time to monitor results and make required adjustments. Some of these adjustments may include eliminating or controlling specific ingredients.

Virtually all ingredients possess some factor which must be eliminated or controlled in order to maximize the nutritional value of the ingredient. In many ways, these factors have been catalysts in the feed milling industry and have led to many advances. You may rely on your CRF member's ability to know, measure and maintain its quality of feeds over the long term.

Research and Diet

The Care and Feeding of a Successful Gamebird Operation

Hunting preserves demand well-feathered, lean and strong-flying gamebirds. Nutrients can have an impact on these essential characteristics. One example is the Bobwhite quail, which doubles its weight every four days during the first couple of weeks. Consequently, the chick needs nutrients for feather formation, bone development and tissue growth.

Because feathers are primarily composed of protein, proper feather development depends on adequate protein consumption. Therefore, a protein deficiency in the feed can lead to poor feather development.

CRF experiments have examined the effects of protein from hatch to 10 weeks of age in quail. A low-protein (26 percent) Starter diet was shown to decrease early growth and resulted in greater feed consumption during hatch to 5 weeks. Feather growth was also much poorer on the 26 percent protein Starter. Higher protein (28 – 30 percent) Starter diets, fed from hatch to five weeks, provided the optimum start as well as excellent early feather growth. In addition, CRF found that continuing birds on a high protein (28 – 30 percent) Starter diet from five to 10 weeks of age did not improve the performance of body weights and feather scores when compared to birds which were switched to a 24 percent Developer diet from five to 10 weeks of age. Following the CRF recommended “step down” in protein levels during the growing cycle will reduce cost and produce good-quality gamebirds.

Hot temperatures, over-crowding and stress can decrease feed consumption, which can lead to poor feather development, increased disease susceptibility and poor growth rate if feed does not contain an adequate amount of nutrients. CRF experiments compared bird performance from hatch to 10 weeks of age under heat stress using different dietary protein and amino acid levels as well as the antibiotic BMD (bacitracin). Other CRF trials were designed to evaluate ways in which nutrition and diet formulation can improve performance of birds under conditions of heat stress. When heat stress was severe, birds decreased their total feed consumption, which resulted in both depressed growth and poorer feather scores on the standard gamebird diets based off NRC nutrient levels. However, the BMD treatment and the CRF experimental “stress” diets demonstrated an improvement in feed intake and feather scores.

Marketing lean birds is also paramount to game bird producers; overweight birds are often lethargic and do not meet the hunters’ expectations. Providing a diet rich in protein relative to energy can help minimize obesity.

CRF Gamebird Feeding Programs provide the producer with balanced energy, protein and amino acid ratios for controlling bird weight while providing superior flight ability and excellent feather cover. Below you will see the CRF recommended nutrient composition of diets for gamebirds from hatching until release on the preserve.

Table 3. CRF Gamebird Feed - Nutrient Profiles

Nutrients	Starter	Developer	Developer	Conditioner	Conditioner	Maintain	Breeder
Protein %	28	24	22	20	18	16	21
Kcal/lb.	1300	1290	1220	1200	1200	1190	1200
Fat %	3.5	3.5	3.5	3.5	3.5	3.5	4.0
Fiber %	3.5	4.0	4.5	5.0	5.0	6.0	3.5
Calcium %	1.0	0.9	0.9	0.9	0.9	0.65	2.5
Available Phos.	0.5	0.5	0.45	0.4	0.38	0.25	0.55
Lysine %	1.5	1.3	1.3	1.1	0.95	0.8	1.2
Methionine %	0.65	0.55	0.55	0.55	0.55	0.45	0.45
TSAA* %	1.1	0.9	0.9	0.9	0.9	0.8	0.8
Vit A	6600	5300	4000	4000	4000	4000	4000
Vit D	1800	1500	1200	1200	1200	1200	1200
Vit E	25	20	20	20	20	20	20
PrimaLac	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Total Sulfur Amino Acids

Table 4. CRF Pheasant Feeding Programs

Feed Type	Pheasant	Cumulative Body Weight	Cumulative Feed Consumed
28% Starter	Hatch – 5 weeks	0.6 lb	1.40 lbs
24% Developer	Optional	-----	-----
22% Developer	6 – 12 weeks	1.90 lbs	6.5 lbs
20% Conditioner	Optional	-----	-----
18% Conditioner	12 – 16 weeks	2.40 lbs	10.60 lbs
16% Maintenance	Maturity – release	2.50 lbs*	12.80 lbs *

*Note – Body weight and feed consumption based on release at 18 weeks of age.

Breeders – Feed game bird Breeder feed at least one month before normal egg production season and continue throughout the breeding season.

Table 5. CRF Chukar Feeding Programs

Feed Type	Chukar	Cumulative Body Weight	Cumulative Feed Consumed
28% Starter	0 – 5 weeks	0.5 lb	1.20 lbs
24% Developer	Optional	-----	-----
22% Developer	6 –12 weeks	1.10 lbs	4.9 lbs
20% Conditioner	Optional	-----	-----
18% Conditioner	12 weeks – release	1.30 lbs*	7.80 lbs*

*Note – Body weight and feed consumption based on release at 18 weeks of age.

Breeders – Feed game bird Breeder feed at least one month before normal egg production season and continue throughout the breeding season.

Table 6. CRF Quail Feeding Programs

Feed Type	Quail*	Cumulative Body Weight	Cumulative Feed Consumed
28% Starter	0 – 5 weeks	4.0 oz	0.60 lbs
24% Developer	6 – 12 weeks	5.0 oz	2.60 lbs
22% Developer	Optional	-----	-----
20% Conditioner	12 weeks – release	5.30 oz**	4.50 lbs**
18% Conditioner	Optional	-----	-----

*Note – Body Weight and Feed Consumption data is based on Coturnix quail.

**Note – Body weight and feed consumption based on release at 18 weeks of age.

Breeders – Feed game bird Breeder feed at least one month before normal egg production season and continue throughout the breeding season.

Non-Nutrient Feed Additives

Anti-microbial agents are compounds given in relatively low concentrations that suppress the growth of pathogenic microorganisms. This class of compounds includes antibiotics and coccidostats. Antibiotics are naturally occurring substances produced by yeast, molds and other microorganisms; coccidostats comprise chemical compounds used to prevent coccidiosis (an infection caused by intestinal parasites).

Anti-microbial agents and antibiotics which have been approved for gamebirds are shown in the chart below. The addition of PrimaLac, a probiotic or Direct-Fed Microbial (DFM), will also improve health and performance. DFMs are naturally occurring microbials. These organisms enhance the population of beneficial microorganisms in the intestinal tract. Research from CRF and North Carolina State University has indicated that supplementing gamebird diets with PrimaLac, a DFM, reduced mortality, increased body weight gain and improved feed efficiency.

Approved Additives for Gamebird Feed

Product and Claims

- PrimaLac (2 lbs/Ton) – improved growth rate, feed efficiency; to minimize mortality
- Bio-Cox (50GM/Ton) – coccidiosis in quail
- Coban (73 GM/Ton) – coccidiosis in quail
- Avatec (113 GM/Ton) – coccidiosis in chukar
- Amprol (0.175%) – coccidiosis in pheasants
- BMD (50GM/Ton) – growth promotion in pheasants
- BMD (200GM/Ton) – Ulcerative enteritis in quail
- Rofenaid (113.5GM & 68.1 GM) – coccidiosis in chukar

Drug recommendations are based upon Feed Additive Compendium. Check the most current edition for modifications with drug usage and product approval.



Further Information

Links to Scientific Journals

- <http://pubs.caes.uga.edu/caespubs/pubcd/B1220.htm>
- <http://pubs.caes.uga.edu/caespubs/pubcd/B1215.htm>
- <http://pubs.caes.uga.edu/caespubs/pubcd/B1218.htm>
- <http://www.msstate.edu/dept/poultry/pubs/pub2383.htm>
- <http://www.msstate.edu/dept/poultry/bwqtopic.htm>
- http://www.ces.ncsu.edu/depts/poulsci/tech_manuals/feeding_quail.html
- <http://animalscience.ucdavis.edu/Avian/gamebird.pdf>
- <http://animalscience.ucdavis.edu/Avian/japanesequail.pdf>
- <http://animalscience.ucdavis.edu/Avian/chukar.pdf>
- <http://www.naga.org/>

Other Considerations

Table 7. Space Requirements

	Age	Floor	Feeder	Waterer
Pheasant	0 - 10 days	4 birds / sq ft	1" / bird	Three 1-gal founts / 100 birds
	10 days - 6 weeks	1 bird / sq ft	2" / bird	4 ft of trough / 100 birds, or 1 round hanging 18" diameter waterer / 75 birds
	6 weeks - mature	1 bird / 4 sq ft	3" / bird	4 ft of trough / 100 birds, or 1 round hanging 18" diameter waterer / 75 birds.
Quail	0 - 10 days	6 birds / sq ft	1/2" / bird	2 chick jars / 100 birds
	10 days - 6 weeks	4 birds / sq ft	1" / bird	Two 1-gal founts / 100 birds, or 1 round hanging 18" diameter waterer / 300 birds
	6 weeks - mature	2 birds / sq ft	1.5" / bird	1 ft trough / 100 birds, or 1 round hanging 18" diameter waterer / 300 birds
Chukar	0 - 10 days	6 birds / sq ft	3/4" / bird	Two 1-gal founts / 100 birds
	10 days - 6 weeks	3 birds / sq ft	1.5" / bird	2 ft of trough or 1 round hanging 18" diameter waterer / 150 birds
	6 weeks - mature	1 bird / 2 sq ft	2" / bird	Two 1-gal founts / 100 birds

Note – A common cause for cannibalism is crowding and/or lack of feed or water space.

A Large Scale Partnership

Providing Innovative, Proven Animal Nutrition Research.

Research of the magnitude needed to be statistically valid is inherently expensive. So it's smart for feed manufacturers to join forces and share expenses.

It's also smart to buy from these cost-savvy feed producers. Because when we're watching out for our dollars, we're watching out for yours too.

By spreading the expense of research over the millions of tons of feed supplied by our members, CRF can keep the costs of research to only pennies per ton of feed.

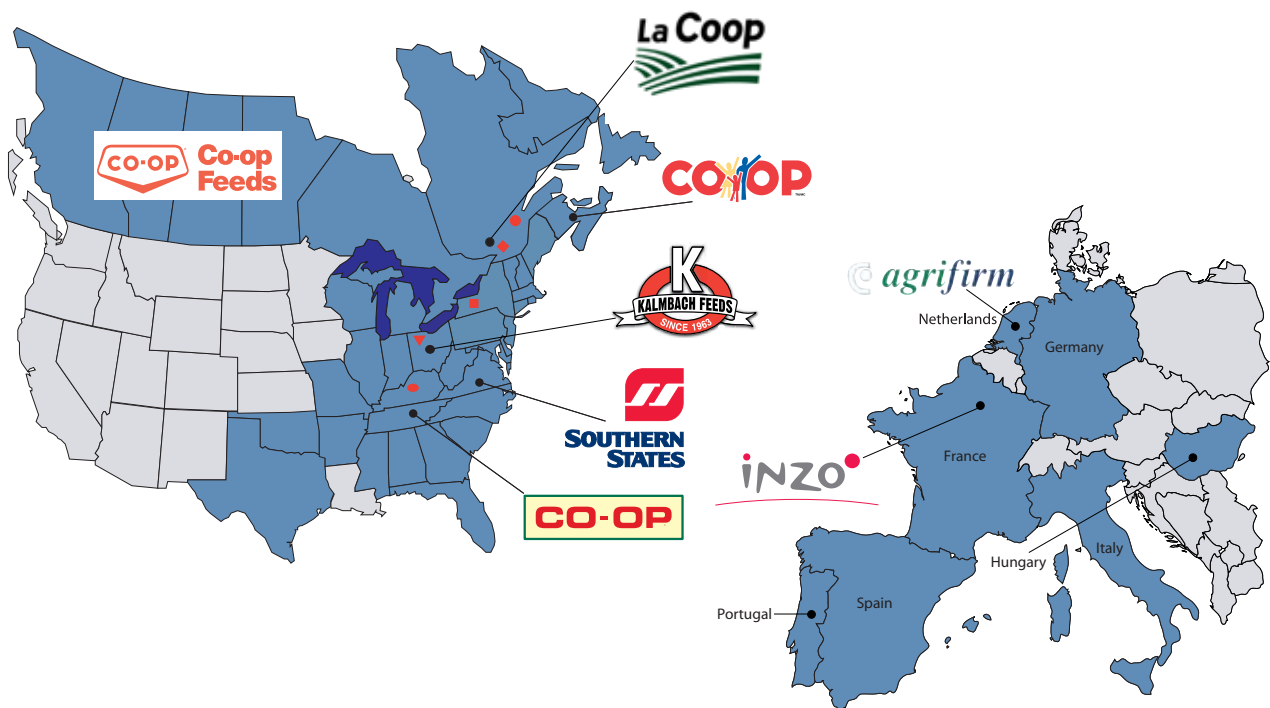
Through innovative partnerships and cost sharing, CRF is able to turn its collective knowledge into profits and increase productivity for its members for over 50 years.

This partnership enables CRF members to be the first with an array of patented techniques and products designed to make farming more profitable for you.



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Providing innovative, proven animal nutrition research.



- Beef Research** ■ **Dairy Research** ◆ **Layer Research** ▼ **Swine Nursery Research**
- Various locations ■ New York, U.S.A. ◆ Quebec, Canada ▼ Ohio, U.S.A.
- Broiler Research** ◆ **Equine Research** ▶ **Sow Research** ▶
- Quebec, Canada ◆ Kentucky, U.S.A. ▶ Quebec, Canada ▶