



# Role of Nutrition on Reproductive Performance

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Often, farmers who are experiencing problems with their cows' reproductive performance wonder if nutrition may be involved. Although nutritional deficiencies or imbalances are one cause of unacceptable reproductive performance, poor reproductive performance also can be caused by diseases, toxins, and management-related problems. Heat detection generally is the single greatest reason for poor reproductive performance in dairy herds using artificial insemination.

Yet, nutritional problems do affect reproduction. Cows in early lactation are under tremendous nutritional demands. During the first 120 days after calving, a dairy cow produces approximately half of the total milk produced in that lactation. During early lactation, the demand for nutrients to support maintenance and milk production is given the highest priority. Thus, reproduction takes a "back seat" until these demands for nutrients are met. The key to getting cows to milk to their genetic potential and to getting them bred back is to provide them with a well-balanced diet composed of quality forages, grain, and a mineral and vitamin mix and to maximize consumption of that diet.

## Importance of Energy

Energy is the most common nutrient limiting reproduction. During early lactation, the peak in feed intake lags behind the peak in milk production. Milk production usually peaks approximately six weeks into lactation, whereas feed intake peaks four weeks later at ten weeks after calving. During this ten-week period, the cow is in a negative energy balance (i.e., more energy is being put into the production of milk than is taken in through her diet). To meet their energy needs, cows rely on their body stores of fat (known as body condition). For every pound of body fat mobilized, enough energy can be supplied to support the production of 7 lbs of milk.

Cows gaining weight during early lactation have a higher conception rate and need less services per conception compared to those losing weight (Table 1).

Cows that lose an excessive amount of body condition or fat stores during early lactation have longer intervals to first ovulation and first estrus (heat

**Table 1.** Effects of a cow's condition on conception rate

Cow's Condition	Total Number Services	Total Number Pregnant	Services/Conception	Conception Rate
Gaining Wt.	1368	911	1.50	67%
Losing Wt.	544	234	2.32	44%

period), lower first service conception rates and more days open. Cows should not lose more than 1.0 unit of body condition when scored on a scale of 1 to 5. On this scale, cows should calve with a body condition score of 3.5-4.0 and milk down to a 2.5 or 3.0.

Improvements in a cow's energy balance may be an important signal to the ovaries to start cycling. Cows may start cycling when they are still in negative energy balance but are starting to return to a positive value. When a cow is returning to a positive energy balance, the magnitude of the negative energy balance may be important in determining the amount of time it takes for her to start cycling again. Preliminary results from research trials indicate that energy balance may also influence developing ova (eggs).

**Heifers** that are not fed adequate amounts of energy reach sexual maturity later. Dairy heifers reach sexual maturity when they are 30-40% of their adult weight. Heifers raised on low-quality hay or grazed on late summer pastures often are energy-deficient.

Overfeeding energy to heifers before they reach puberty also is very harmful. Heifers which are overfed will reach adequate weight at an early age but will lack sufficient bone growth, especially in the pelvic area, which increases calving difficulty. Excessive weight gain is more harmful to heifers before they reach puberty than after they are bred. Overfeeding heifers before puberty (before nine months of age) can cause heifers to store excessive fat tissue in the developing udder and decrease the amount of milk-producing tissue. Young heifers fed grain through self-feeders may be predisposed to this problem.

## Importance of Protein

**Protein deficiencies** in lactating cows may increase the incidence of silent heats (cow releases the egg but she is not seen in heat) and lower conception rates while at the same time decreasing feed intake and milk production. Cows which are deficient in protein increase milk production within a couple of days when additional protein is added to the diet. First-calf heifers may be more sensitive to protein deficiencies than mature cows.

Heifers that are raised on a protein-deficient diet lack the skeletal growth in relation to their size, especially in the pelvic area. These heifers are older when they start cycling, have more difficulty calving, and may not milk as well once they enter the milking herd.

**Excesses of protein** (crude protein in the total diet greater than 17-20%) have been implicated in lowering conception rates with increases seen in the number of

services per conception and days open. These observations have not been consistent and may depend more on the amount and type of protein and amount of energy supplied in the diet than the amount of crude protein. When an excess of degradable protein and/or a deficiency of energy is fed, ammonia not incorporated into microbial protein is absorbed into the blood stream. In turn, this excess ammonia and urea in the blood stream may decrease fertility at the same time energy is diverted away from milk production and/or reproduction. Some studies have indicated that blood urea nitrogen (BUN) above 20 mg/100 ml may decrease the chances of pregnancy.

## Importance of Vitamins and Minerals

Requirements of vitamins and minerals need to be met to ensure optimal reproductive performance. They should be added to the grain mix and/or total mixed ration to make sure all cows receive adequate amounts. Cows will not consume the amount of minerals they need if only provided free-choice.

Listed below are reproductive problems that may be seen when various minerals or vitamins are not provided in adequate amounts. Notice that several minerals and vitamins can be implicated in any reproductive problem. For example, deficiencies of calcium, selenium, copper, iodine, and vitamins A and E can result in an increased incidence of retained placentas. Therefore, dairy cows need to be fed the recommended amounts of minerals and vitamins. Table 2 lists the recommended concentrations of these minerals and vitamins in diets for lactating dairy cows.

### Macrominerals

**Calcium:** A calcium deficiency in young calves prevents normal bone growth and retards their general growth and development. In cows with milk fever, the uterus returns to normal size more slowly after calving. These cows also have an increased incidence of dystocia (trouble giving birth), retained placenta, and prolapsed uterus. The ratio of calcium to phosphorus in milking cow diets should be kept between 1.5 to 2.5. However, one must remember that the amount of each of these minerals is more important than the calcium-to-phosphorus ratio.

**Phosphorus:** Phosphorus deficiencies decrease fertility, feed intake, and milk production. At the same time, cattle may be lethargic and unthrifty. Usually other deficiency symptoms are seen before

infertility. In particular, phosphorus deficiency results in a lower conception rate, a decrease in ovarian activity, irregular estrus cycles, anestrus (inactive ovaries), and an increased incidence of cystic ovaries.

## Trace Minerals

**Selenium:** Retained placentas are the most common reproductive problem associated with selenium deficiency. But early embryonic deaths, increased metritis (an infection of the uterus), poor fertility, and the birth of dead or weak calves also are associated with low levels of selenium. Rations fed to dairy cows in Kentucky should be supplemented with the legal limit of 0.3 ppm selenium in the total ration dry matter. Dairy farmers should remember that a selenium deficiency is not the only mineral and vitamin deficiency that can cause retained placentas. Deficiencies of calcium, copper, iodine, and vitamins A and E increase the incidence of retained placentas.

**Copper:** A deficiency of copper is associated with early embryonic death, reduced ovarian activity, delayed or reduced estrus activity, decreased conception rate, increased incidence of retained placenta, and increased difficulty in calving. The availability of copper is reduced by excesses of calcium, sulfur, iron, zinc, and molybdenum in the diet or water.

**Zinc:** Zinc deficiency reduces spermatogenesis (the production of sperm) in the bull, delays sexual maturity, and can cause fetal abnormalities.

**Iodine:** Iodine has an indirect effect on reproduction through its action on the thyroid gland. Iodine deficiencies may indirectly cause early embryonic death, abortion, stillbirths, prolonged gestation (time the calf is carried in the uterus), and an increase in the incidence of retained placenta.

**Manganese:** Manganese deficiency is rare in ruminants. Cows deficient in manganese are likely to have poor development of the follicles, delayed ovulation, more silent heats, and lower conception rates. These cows also tend to abort and give birth to weak calves.

**Cobalt:** Cobalt deficiency is associated with an increased incidence of silent heats, a delayed onset of puberty, nonfunctional ovaries, and abortion.

## Vitamins

**Vitamin A:** Vitamin A is the most commonly deficient vitamin in cattle. Vitamin A is necessary in maintaining the health and integrity of epithelial tissue (tissue that lines the reproductive tract, intestinal tract, urethra, kidney, mouth, respiratory tract, salivary glands, eyes, and tear glands). These tissues become hard and crack during a vitamin A deficiency. Deficient

**Table 2.** Recommended minimum concentrations of minerals and vitamins to be included in the ration dry matter (includes all feeds eaten) for a Holstein cow producing 70 lbs milk at 4.0% butterfat or Jersey producing 43 lbs milk at 5.0% butterfat.

### Recommended Concentration in Total Ration Dry Matter

#### Macrominerals

Calcium	0.60%
Phosphorus	0.38%
Magnesium	0.20%
Potassium	0.90%
Sodium	0.18%
Chloride	0.25%
Sulfur	0.20%

#### Trace Minerals

Iron	50 ppm
Cobalt	0.10 ppm
Copper	10 ppm
Manganese	40 ppm
Zinc	40 ppm
Iodine	0.60 ppm
Selenium	0.30 ppm

#### Vitamins

Vitamin A	1450 IU/lb
Vitamin D	450 IU/lb
Vitamin E	7 IU/lb

*Taken from: Nutrient Requirements for Dairy Cattle. 6th Revised Edition. 1989. National Academy Press.*

cattle are highly susceptible to infections and colds, and pneumonia often occurs. Reproductive problems associated with a vitamin A deficiency include delayed sexual maturity, abortion, birth of dead or weak calves, retained placenta, metritis, and shortened gestation periods. Supplementation with vitamin A should be considered when feeding poor quality forages or low amounts of forage and corn silage.

Beta-carotene is a precursor of vitamin A. Early research showed that reproductive performance was improved when cows were supplemented with beta-carotene. However, recent studies have not shown improved reproduction performance with supplemental beta-carotene.

**Vitamin D:** When cattle are exposed to sunlight, they manufacture their own vitamin D. Vitamin D is necessary for normal calcium and phosphorus metabolism and, thus, affects reproduction indirectly.

**Vitamin E:** The function of vitamin E on reproduction is not clearly defined. Selenium and vitamin E are closely related, but each is believed to function separately.

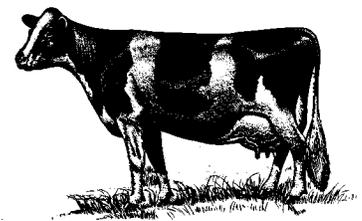
## Nutrition Is the Key

Feeding your cows a balanced ration composed of quality forages and a grain mix that complements these forages will help reduce reproductive problems. Each time changes are made in either the type or quality of forages fed, new forage samples should be taken and sent to a forage analysis lab. In addition, feed intake should be measured. This information can be used to make sure your cows are receiving an adequate amount of protein, energy, minerals, and vitamins. At the same time, cows should be managed to maximize the amount of dry matter they consume. This is especially important in early lactation cows because of the high demand for nutrients.

During the second half of the lactation, cows need to regain the body condition they lost during early lactation. Cows are more efficient at gaining body weight or fat stores (body condition) when they are milking than when they are dry. These fat stores can be used in the next lactation to make 1500 lbs of additional milk and can have a beneficial effect on reproductive performance. Cows should calve with a body condition score of 3.5-4.0 and milk down to a 2.5-3.0 during early lactation. We do not want cows to calve too fat or too thin.

### To increase the chances of getting cows bred back early:

- Feed cows a balanced ration.
- Feed high quality forages so they can get the quantity of nutrients they need.
- Maximize feed intake (dry matter intake) especially during early lactation.
- Restore body condition the second half of the lactation.



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