

THE ORGANIC FARMING PHILOSOPHY AND ITS EFFECT ON UDDER HEALTH

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Although organic farming is the oldest form of agriculture on earth, interest in these methods has re-emerged in recent years. Post-war technologies in the 1940's industrialized agriculture and made it possible to produce large volumes of food economically. Unfortunately, with this came environmental and social costs.

In response to the industrialization, interest in returning to more sustainable farming methods arose in both Europe and the United States. In Austria, Rudolf Steiner was a proponent of biodynamic farming while in England Lord Northbourn coined the term 'organic'. This term was used to describe sustainable farming systems which were dynamic and balanced and relied little on external inputs.

In 1940, Sir Arthur Howard published *An Agricultural Testament*, a treatise on soil fertility and rehabilitation. In the United States, J. I. Rodale read Sir Howard's work and established a farm in Pennsylvania so that he could put this knowledge into practice. In 1942, he began publishing *Organic Farming and Gardening*. Rodale promoted the idea that long term soil health depends on high levels of organic matter (which he thought were more readily usable to plants than chemical fertilizers) to restore nutrient balance and retain moisture. He also argued that external chemical inputs destroyed the natural microbial flora that was necessary for healthy soil.

The Rodale Institute was created in 1947 (and was originally known as The Soil and Health Foundation). The mission of this organization was to conduct research and promote education in sustainable agricultural practices and composting. Interest in these farming methods continued to grow into the 1980's. Involvement of the USDA helped to establish the Sustainable Agricultural Research and Education (SARE) program which provides funding for initiatives in sustainable methods.

By the late 1980's there were a variety of state and private certifying agencies that certified farms as organic, providing consumers with the assurance that the organic products were produced legitimately. The rules and regulations varied widely from agency to agency, however. To curb instances of fraud in the organic market place and promote organic commerce, the Organic Foods Production Act of 1990 was enacted. This act mandated the creation of the National Organic Program (NOP) and the creation of uniform federal standards. All producers, handlers, processors and certifiers who generate more than \$5000 per year in gross receipts needed to be in compliance with these federal regulations by October, 2002. A complete copy of the NOP's Regulations and Guidelines may be accessed on the following website: <http://www.ams.usda.gov/nop/indexIE.htm>.

Philosophy

Farming organically in the United States involves one key concept as its cornerstone. Organic products must use materials and methods that conserve natural resources, rebuild soil health, control pollution of air, land and water, and promote a healthy and diverse ecosystem. Integrity of organic products must be preserved throughout production, processing and handling so that there is no commingling of organic and conventional products or contamination of organic food or materials with prohibited substances.

Most synthetic fertilizers, herbicides, pesticides and therapies are prohibited from use on the organic farm. Soil health is promoted through crop rotation, green manuring, cover crops, composting and the use of mined minerals. Maintenance of animal health is focused largely on preventive measures and proper nutrition, management to reduce stress, and housing systems that allow livestock to display their natural behaviors.

Guidelines and Regulations

The National Organic Program is housed within the United States Department of Agriculture (USDA) under the direction of the Secretary of Agriculture. The organic standards are based on recommendation of a 15-member advisory National Organic Standards Board (NOSB). Producers, consumers and any interested party may bring topics related to organic production or commodities before the NOSB for consideration.

The Secretary of Agriculture has established a National List of Allowed and Prohibited Substances based on recommendations of the NOSB. This National List identifies synthetic substances which may be used, and non-synthetic substance which *may not* be used in organic production. Any individual can petition the NOSB to request that a substance be added to or removed from the National List.

All state and private certifying agencies must be accredited by the USDA. Certifying agencies may have more stringent requirements for organic certification than the NOP regulations but they can never institute exceptions to the organic rule.

To be able to display the “USDA Organic” seal on packaging and to advertise products as ‘certified organic’, all production, handling and processing must be in accordance with USDA regulations. These regulations, as they pertain to the organic dairy industry, are briefly summarized below.

Land for crops and pastures is transitioned to full organic status over a three year period. No synthetic chemicals (pesticides, herbicides, fertilizers, fungicides) or plants and seeds that have been genetically modified may be used on crop or pasture land. Transition begins at the date of the last application of a prohibited substance. Split operations (having both conventional and organic land or livestock on the same farm) are not allowed. There also must be a buffer zone between organic and conventional lands; the size and construction is dependent on land topography, type of crop, drainage and wind direction.

During the final year of land transition, the producer is allowed a one-time transition of his dairy livestock. During this transition year, all animal management standards must be in accordance with federal regulations.

100% organic feed must be consumed by the animals during the last three months of transition. Currently the standards allow for cattle to be fed 80% organic and 20% conventional feeds during the first nine months of the transition year. This is expected to change to a 100% organic feed requirement during the transition year because of recent litigation. All livestock greater than six months of age must have access to pasture during the growing season and have access to outdoor exercise areas on a year round basis. Calves must be raised on whole milk; milk replacers are not allowed except in emergency circumstances (and then must be antibiotic and rBST free).

Organic dairying does not simply rely on ‘input substitution’ (substituting alternative therapies for prohibited conventional substances). Preventative practices are the key requirement for animal health maintenance on the organic farm and these practices must be documented in the farm plan. Antibiotics, hormones, and most synthetic therapies are not allowed in animals whose products will be certified organic. This is in contrast to the European system, where limited amounts of antibiotics and synthetic treatment may be administered, but only by a licensed veterinarian. The National List gives some guidance on allowed, regulated and prohibited products for use although the onus falls on US producers to be certain that any product employed meets federal regulations. Alternative health therapies (botanicals, homeopathy, supportive care, acupuncture) are frequently used when treatment is necessary. Vaccinations are permitted and synthetic dewormers are allowed *on an extremely restricted basis* when alternative therapies have failed. For humane reasons, when alternative methods have been exhausted, no prohibited treatment may be withheld from an animal simply to maintain organic status. The animal must be treated and then removed from the farm (sold to a conventional herd or culled). Dehorning is permitted but tail docking is prohibited.

Certification must be renewed annually at the farmer’s expense and all paperwork, land and livestock are scrutinized by the certifier’s inspector during a multi-day visit. The farm must keep detailed records on all crop and pasture land inputs and harvests, receipts from all purchases (feed, animal, therapies) and animal production and health records. All animals must also be permanently identified. These records are reviewed by the inspector on an annual basis. Unannounced spot farm inspections may occur throughout the year. Violations may result in delayed transition, fines or revocation of organic status.

At the USDA level, quality standards for organic milk do not differ from those for conventional milk. At the processor level, differences may exist, as discussed below under udder health.

The Organic Marketplace

Consumer demand and perception of organic foods

Milk is a generous source of valuable nutrients (energy, protein, fatty acids and essential minerals and vitamins) and consumers are becoming more aware of the link between diet and health. Many seek out organic meat and milk products and expect that these products will have

greater health benefits than conventionally produced products (Food Marketing Institute, 2001). Multiple consumer surveys have identified interest in health benefits as well as preservation of the environment and animal welfare concerns as motivating factors for the purchase of organic products (Hodges 2003; Magnusson et al. 2002; Makatouni 2001).

Growth of the organic sector

Although organic milk accounts for less than 1% of the US milk market, this sector is growing at an exponential rate. The organic dairy segment was the fastest growing segment of the natural foods market in the 1990's with sales increased by 500%. The number of certified organic cows increased by 277% between 1997 and 2001 (Dimitri and Greene, 2002). Recently, the Northeast Organic Dairy Producers Alliance (NODPA), the largest support group for organic dairies in this region, estimated their current membership numbers include 454 dairies. Breakdowns by state were: Connecticut, Massachusetts, and New Hampshire (2 farms per state), Maine (65), New York (138), Pennsylvania (132), Vermont (105) and Virginia (8) (personal communication, Flack 2005). As an example of growth, in 2001 there were 49 organic dairy farms in Vermont (Barlow, 2001).

Demand for organic dairy products vastly exceeds production in the Northeast; consequently, there is a large push from the major processors (Horizon, Organic Valley, and Hood) to encourage more farms to transition to organic production. The market offers a stable price (base of \$22 to \$23 per cwt.) and quality premiums up to \$2 per cwt.

Udder Health on the Organic Farm

As in the world of conventional dairying, mastitis is one of the most important diseases on organic dairy farms (Busato et al., 2000; Kossaibati and Esslemont, 1997). Little has been documented regarding disease prevalence in US organic dairies; most of the current information comes from the European Union.

Organic milk must meet all the minimum regulations passed the Interstate Milk Shippers (IMS). However, historically retailers have pressured organic milk processors for products with a long and stable shelf life. Large processors meet these demands through ultra-pasteurization and by contracting with these farmers to accept only bulk milk with somatic cell counts (SCC) of less than 400,000 cells/ml. If counts exceed 400,000 cells/ml, the farms may be enrolled in a 'Work Improvement Program' and will have monies deducted from the milk check until counts are back in compliance (personal communication, 2005). Therefore, organic farmers in the Northeast are under even greater pressure than conventional farmers to control mastitis on their farms.

Statistics on mastitis incidence and prevalence (both clinical and subclinical) and bulk milk SCC on organic farms are limited and vary among authors. Busato et al. reported a subclinical mastitis prevalence of 21.2% for 1-100 days in milk (DIM) and a prevalence of 34.5% for 101-305 DIM. A Danish study found no difference in bulk milk SCC between newly transitioned organic herds and conventional herd; however, the longer the herds were managed organically, the lower the bulk milk SCC (Bennedsgaard et al., 2002). Similarly, Hardeng and Edge (2001) found no difference in bulk milk SCC but did find a lower incidence in mastitis in a comparison of organic and conventional dairies in Norway. A three year study in the United Kingdom

reported a clinical mastitis rate of 34.4% (5-85%); however, this was not significantly different from conventional herds during the same time period (Weller and Bowling, 2000). Vaarst also reported no difference between bulk milk SCC, clinical or chronic mastitis, or the number of mastitis treatments from organic and conventional dairy herds in Denmark (Vaarst proceedings) All farms involved in these previous studies employed at least selective use of antibiotics for the treatment of mastitis.

As previously stated, antibiotics are not employed routinely (even selectively) on US organic dairies and so results from US studies on prevalence and incidence of mastitis might be expect to differ from studies performed in the EU. Sato et al. recently published a comparison of production and management parameters between organic and conventional herds in Wisconsin and found no difference between the two types with regard to bulk milk SCC and clinical mastitis rate per 100 cow-years. Organic herds were significantly smaller and had lower production than conventional herds (Sato et al., 2005). We found that organic herds in New York had a significantly lower bulk milk SCC when compared to conventional herds and similarly to Sato's results, milk production was lower on organic farms (Tikofsky, et al., 2003).

With a prohibition on antibiotic use on US organic farms, good udder health must focus on prevention and management strategies. Milking machine maintenance, proper nutrition, post milking teat disinfection, and environmental cleanliness have all been associated with decreased bulk milk SCC and reduced clinical mastitis (Schukken et al., 1990; Barkema et al., 1998). The reduced milk production by organic cows may have an impact in reducing the mastitis since the incidence of metabolic disorders, such as ketosis and milk fever, on organic farms is decreased (Hardeng and Edge, 2001; Vaarst and Enevoldsen, 1994). Smaller herd size may play a role in increase attention to the individual animal, reducing stress and allowing for earlier interventions for mastitis.

Many organic producers have indicated that mastitis in early lactation is a big challenge in maintaining quality milk. Month of calving appears to have an impact on increased first linear scores at calving in the author's experience. Data were available from three similarly managed herds in New York (total cows=500) and percentage of cows freshening with a linear score greater than 4.5 (equivalent to 285,000 cells/ml) was graphed by month of freshening (Figure 1). A higher percentage of cows that were dried off during the indoor housing period (November to March) had a first linear score (LS1) greater than 4.5 than cows who were dried off during the pasture months (April to October). Exposure to sunlight, good ventilation, and rotational grazing which presents a new 'housing' area every few days appears to have an impact on udder health.

A Practical Udder Health Plan for Organic Dairy Herds

The NMC (formerly the National Mastitis Council) has established a Ten-Point Control Program which can easily be adapted for use on organic dairies and this adaptation is presented on the following pages (www.nmconline.org).

Eight Steps to Better Udder Health

1. Set farm specific udder health goals

These will vary from farm to farm depending on the challenge facing the farm, the certifying agency, and producer philosophy. Realistic, achievable goals for the majority of farms are:

- 0% *Streptococcus agalactiae* and 0% *Mycoplasma*
- <5% *Staphylococcus aureus*
- Bulk tank SCC < 200,000 cells/ml
- Fewer than 5% new infections each month
- 5-7% or less chronic infections
- 2-3% clinical mastitis

2. Implement a plan to regularly monitor udder health

This can most easily be done with regular cell count testing through the Dairy Herd Improvement Association (DHIA) but effective monitoring with a strip cup, visual observation, and a CMT test can also achieve goals. Once a month evaluate the udder health of all lactating animals. Cows with high cell counts on two consecutive DHIA tests or two monthly CMT tests should be cultured so they can be milked last, monitored, managed with an alternative therapy, or culled. Clinical mastitis cases should also be cultured so that intervention opportunities in the environment can be instituted. Semi-annual meetings with your certifier, veterinarian, and nutritionist to evaluate the current mastitis control program and review udder health goals are advised.

3. Proper milking procedures

A proper milking routine should be instituted at all milkings and be followed by all milkers. Cows crave consistency so having a standardized procedure will reduce stress and enhance milk letdown and milkout. Components of a good milking procedure are:

- *Udder wash/Predip:* Visibly dirty teats should be washed or predipped and wiped clean before units are attached. Single use towels should be used on each cow: Do not share towels between cows as this will spread mastitis.
- *Forestripping:* Removing 3-4 squirts of milk from each teat prior to milking helps stimulate the milk letdown response. Cows will milk out faster and on-time of the milking unit will be decreased so that damage to teat ends will be minimized. Forestripping also allows you to identify clinical mastitis earlier and also removes milk in the teat end that is higher in bacteria and somatic cells. Forestripping should be done into a cup or into the gutter so that bedding and hands do not become contaminated with milk.
- *Gloves:* Gloves (either nitrile or latex) should be worn at milking time to reduce the risk of spreading mastitis on hands. Gloved hands are more easily disinfected between cows or when contaminated with milk or manure than bare skin
- *Milking order:* Cows infected with contagious mastitis should be identified permanently (leg bands) and milked last or with a unit designated just for them at each and every milking.
- *Overmilking/machine stripping:* It is not necessary to get every drop of milk out of the cow's udder. Leaving the units on the cow when milk flow is low or pulling down on units will damage teat ends: keratin that develops at the teat end and has some natural antibacterial properties will be removed. Overmilking will also cause eversion of the teat sphincter and development of scar tissue which leads to multiple problems. The teat

sphincter and its ability to close between milkings is the first line of defense against mastitis. Scars and cracks that damage teat ends are more likely to be colonized by *S. aureus* and will increase the risk of mastitis.

- *Attention to post milking teat dipping:* Attention to the selection and application of post milking teat dip is of utmost importance in herds with contagious mastitis. If an uninfected cow is unknowingly milked after an infected cow, contagious bacteria are deposited on the milk film of the teats. There they will multiply and move toward the teat end in an attempt to infect. Applying post milking teat dip to at least 2/3 of each teat will kill bacteria before they have a chance to multiply and spread on the milk film. Teat dips should contain at least 10% teat skin conditioners to maintain udder health and prevent chapping and cracking.

4. Maintain milking equipment regularly

The mechanical milking system (including dynamic testing) should be evaluated by a qualified individual at least twice yearly. Vacuum fluctuations, due to liner slips, flooding, inadequate vacuum reserve, and poorly functioning regulators, are likely to force bacteria up the teat end during milking and increase the risk of mastitis.

Rubber milking liners should be replaced every 800 cow milkings or every 60 days, whichever comes first. Rubber used longer than this deteriorates and will develop microscopic cracks that hold mastitis bacteria even through the wash cycle. Other rubber parts (hoses, tubes, gaskets) should be inspected regularly and replaced when worn.

5. Evaluate dry cow management

Although dry cow antibiotic therapy is not permitted in organic dairy production, this is still an important time for udder health improvement and rejuvenation of milking tissue. Energy intake should be reduced one week prior to dry off so that milk production is decreased. At dry off, the udder should be milked out one final time and the teat ends dipped with post milking teat dip twice daily for two weeks after dry off. It takes about two weeks for the keratin plug to seal the teat end and prevent the development of new infections during the dry period. Until those plugs form, we need to do our best to sanitize the teat end and prevent contamination by keeping the cow in a clean dry environment. As the cow dries up, changes occur in the mammary secretions that kill bacteria (increases in lactoferrin and alpha-lactoglobulin, increases in antibody levels) and help resolve existing infections. Nutrition of the dry cow is also important especially as she reaches the prefresh period. At this time, selenium and vitamin E levels become important for support of the immune and reproductive systems and to ensure the birth of a vigorous calf. The National Research Council recommends that 0.3 ppm per head per day of selenium and at least 1500 IU of vitamin E per head per day be fed. For continued udder health benefits, supplementation of selenium and vitamin E is recommended throughout lactation.

A clean comfortable environment is important to prevent new environmental infections and to prevent teat injuries. When cows are housed inside in winter, stalls should be scraped frequently and sufficient amounts of clean, dry bedding should be available. Pasture environments for dry cows in the summer are generally preferred but wet areas around ponds and streams should be fenced off so that they do not become muddy loafing areas.

6. Institute biosecurity and culling guidelines

Bringing new animals into an established herd is a risk for introducing many diseases (BVD and Johne's to name a few) besides mastitis into your herd. Spending a little money up front to ensure the cows entering are healthy may save thousands in disease eradication dollars. As mentioned before, multiple bulk tank samples should be cultured for both the usual mastitis bacteria and *Mycoplasma*. If this is not possible, new additions should be milked separately and cultured as soon as possible once they are added to the farm. Although heifers are generally thought to be safe to introduce, they may also be infected and warrant similar segregation and testing protocols.

As contagious mastitis cows are identified, strategic culling methods should be used to slowly reduce the prevalence in your herd. Milk these cows separately. Place cows infected with contagious mastitis on the 'Do Not Breed' list. Remove as soon as possible cows with continued high cell counts or scarred and abscessed bags. For herds with a high prevalence of *Staph aureus* cows that need to reduce bulk milk cell counts as soon as possible, infected quarters should be identified by culture and dried off to prevent that milk from entering the bulk tank and food supply.

7. Environment

As mentioned previously, a clean, dry comfortable environment is essential to good mastitis control. Properly sized, maintained and well-bedded stalls will prevent teat damage that may lead to *S. aureus* mastitis. Consider segregating contagious mastitis cows to one area of the barn so that infected milk that leaks onto bedding does not become a reservoir of potential problems for clean cows. Since flies have been shown to spread mastitis, in particular *S. aureus* and *A. pyogenes*, good fly control is essential to the prevention of mastitis.

8. Youngstock and replacements

Replacement animals are the future of the herd and are a key element in maintaining low bulk milk SCC in herds battling contagious mastitis. If we can keep this group clean and healthy, the farm's financial future is ensured.

Contagious mastitis can be spread to youngstock via two ways when mastitic milk is fed to calves. Bacteria from mastitic milk can live in the tonsils and other immune tissues of the mouth for up to two weeks post weaning. If calves are housed together during this period and cross-suckle, contagious mastitis bacteria can be introduced into the juvenile udder and subsequently that heifer may freshen with contagious mastitis. Also, if calves are allowed to roam in the barn, they may nurse from a cow infected with contagious mastitis and then suckle from a non-infected cow thereby spreading mastitis. Even in herds where cross-suckling is not a problem, flies feeding from milk buckets and then on skin and hair, may also spread contagious mastitis bacteria to the juvenile udder. Again, fly control is important.

In herds that have problems with contagious mastitis and are feeding waste milk, a number of preventive measures are recommended. Calves should be separated while on milk and for two weeks after weaning. This is best accomplished via calf hutches but can also be accomplished

by tying calves apart. Good fly control during the summer months. If possible, pasteurize milk before feeding to calves. Although this does not 'sterilize' the milk, it will drastically reduce the number of infective organisms. In herds with a known contagious mastitis problem, culture first calf heifers as they freshen. This allows you to identify infected cows early and segregate them. Alternative therapies which enhance the immune system may have more of an effect if Infections are caught early.

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Figure 1. Percentage of all calvings where first SCC test is greater than 300,000 cells/ml.

