Organic Matters

ATTRA's *ORGANIC MATTERS* SERIES

CONSIDERATIONS IN ORGANIC HOG PRODUCTION

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Contents:

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Introduction

At the time of this writing, the National Organic Program is scheduled to begin implementation of the Final Rule for national organic standards on April 22, 2002. As of this date, any producers seeking initial certification will have to comply with the NOP standards. Producers who are already certified (by an agent that has received USDA accreditation) will have to achieve compliance with the NOP standards at their next annual inspection. Farmers and certifiers are struggling to understand regulations that provide clear-cut do's and don'ts on a few matters, and oceans of ambiguity on others. One of the areas where the most ambiguity exists is in livestock production.

This publication takes a look at organic hog production specifically. While not attempting to be comprehensive, it focuses on a number of areas of compliance, and more importantly, on some overarching issues of sustainability and animal welfare. In so doing, it provides a glimpse of the many faces of organic agriculture—faces that show the diversity of philosophies and interests brought together under the expanding umbrella of organics.

Sustainable Organic Agriculture

The industrial model that drives conventional agriculture has evolved, over time, to separate the production of livestock feed and the production of livestock into specialties of their own. As a result, animals are increasingly grown in large-scale confinement production settings—far removed from the fields where their feed is produced. Their manure, in turn, becomes a waste product and potential pollutant too costly to haul back to those same fields where it would be a valuable fertilizer.

The reintegration of livestock with the land base is a key concept of sustainable agriculture, and is fundamental to organic farming. In the Minnesota *Greenbook 2000*, farmer Jim Van Der Pol comments, "to separate livestock from the land impoverishes land, reduces the usefulness of livestock and interferes with fertility of the entire system. The separation is a major roadblock to long term farm profitability to say nothing of agricultural system health" (1). Livestock make it possible to add alternative crops and forages to cropping rotations, to utilize weather-damaged crops that were intended for human consumption, and to make use of marginal land or land not suitable for raising crops (2).

Bringing crop and livestock production back together on the farm is sound from an agroecological and farm-systems standpoint. It also provides the farmer with greater marketing flexibility since crops can be marketed directly when grain prices are good, or processed into animal products when they are not.

U.S. Organic standards do not require that production of feed occurs on the same farm unit where livestock is produced, or that manure is recycled back to the feed-crop fields. The author

and NCAT/ATTRA, however, believe that these practices are fundamental to all *sustainable* organic systems. Therefore, even though specialized feeding operations will likely be certified under the Final Rule, this document will favor strategies that integrate crop and livestock production on the same farm.

The Animal Welfare Issue

From protests over fox hunts to the wearing of fur, animal welfare issues have grabbed a lot of press attention in recent years. Most of the protests have been in Europe, but increasing scrutiny of the U.S. hog industry by animal researchers, animal welfare activists, and large pork buyers may force the U.S. pork industry to reconsider practices that many consumers consider objectionable. The issue that has raised the most concern to date is the use of metal gestation crates in most large-scale confinement production systems.

Concerns about animal welfare have also risen with regard to organic livestock. These concerns are various and each is important to one constituency or another. Two issues that NCAT/ATTRA staff find especially compelling are: 1) the relationship between livestock welfare and agricultural sustainability, and 2) the displacement of good husbandry practices by synthetic inputs and other questionable management methods.

Producers commonly use the term "stress" to describe the negative effects of practices and conditions on livestock. Among the obvious sources of stress are lack of good nutrition, parasites, overcrowding, flies, temperature extremes, lack of shade, and brutal handling. However, stress can be recognized more broadly as the inability of the animal to pursue its natural instincts. Stress results in disease and in abnormal, destructive behavior. Ultimately it can lead to economic losses through weight loss, quality loss, higher vet bills, and death losses.

Stress levels can be especially high under large-scale confinement where livestock are denied access to pasture or bedding, where space to move freely or even to lie down is limited, and where the air quality is poor—full of dust and toxic gases. The conventional confinement response to stress-related problems is sub-therapeutic feeding of antibiotics to stave off disease, and excessive physical alterations to blunt the effects of abnormal behavior. In neither case is stress relieved, and only the worst of its symptoms are treated.

This leads to a second principle (after sustainability) that will underlie further discussion—that organic management of livestock should be based primarily on reducing or avoiding stress as opposed to covering up its symptoms with synthetic inputs or unnatural practices.

Further discussions in this document are based on the principles that:

• The production of organic livestock should involve raising animals on the same farms where most of their feed is grown, and where manure is recycled efficiently and ecologically.

• Organic livestock management should be based primarily on reducing and avoiding stress as opposed to treating or compensating for the symptoms of stress.

We will refer often to the American Humane Association (AHA) and the Animal Welfare Institute (AWI) criteria and guidelines for humane hog production. The AHA Free Farmed

labeling program is a certification process verified by the USDA/Agricultural Marketing Service for inspecting and accrediting producers and processors that follow and meet their guidelines. The Niman Ranch Pork Company in Thornton, Iowa purchases slaughter hogs that are raised following the criteria of the AWI and markets these natural pork products under their label on the East and West coasts. The established criteria and guidelines of these associations will likely play a significant role in helping to formulate the USDA organic rules for pork production.

Definitions

NOP: The National Organic Program will facilitate domestic and international marketing of fresh and processed food that is organically produced, and assure consumers that such products meet consistent, uniform standards.

Final Rule: The Final Rule establishes national standards for the production and handling of organically produced food and fiber.

OFPA: The Organic Foods Production Act of 1990 is the congressional mandate that established the NOP.

NOSB: The National Organic Standards Board, formed as a result of the OFPA, advises the NOP on promulgating OFPA regulations.

National List: The National List of Allowed and Prohibited Substances for use in organic production and handling.

What the USDA Rule Requires

Here are some of the requirements for organic hog production under the NOP's Final Rule. To see all the livestock standards and other sections of the Rule, go to <http://www.ams.usda.gov/nop/nop2000/nop2/finalrulepages/finalrulemap.htm>.

205.238 Livestock health care practice standard.

(3) Establishment of appropriate housing, pasture conditions, and sanitation practices to minimize the occurrence and spread of diseases and parasites

(4) Provision of conditions which allow exercise, freedom of movement, and reduction of stress appropriate to the species:

205.239 Livestock living conditions.

(a) The producer of an organic livestock operation must establish and maintain livestock living conditions which accommodate the health and natural behavior of animals, including:

(1) Access to the outdoors, shade, shelter, exercise areas, fresh air, and direct sunlight suitable to species, its stage of production, the climate, and the environment;

(4) Shelter designed to allow for:

(i) Natural maintenance, comfort behaviors, and opportunity to exercise;

(ii) Temperature level, ventilation, and air circulation suitable to the species; and
(iii) Reduction of potential for livestock injury;

(b) The producer of an organic livestock operation may provide temporary confinement for an animal because of:
(1) Inclement weather;
(2) The animal's stage of production;
(3) Conditions under which the health, safety, or well being of the animals could be jeopardized; or
(4) Risk to soil or water quality.

(c) The producer of an organic livestock operation must manage manure in a manner that does not contribute to contamination of crops, soil, or water by nutrients, heavy metals, or pathogenic organisms and optimizes recycling of nutrients.

Understanding Hogs

When it comes to organic livestock, hog production appears to be relatively unexplored territory. With few good guidelines or precedents to follow, it is useful to consider the animals' natural behaviors so that the appropriateness of different housing options, herd management schemes, and so forth, can be assessed.

Instinctive behaviors have evolved to enable pigs to survive and reproduce. Despite the process of domestication, these behaviors have not disappeared and are fully comparable to those of the pig's wild ancestors. Not allowing hogs to perform these instinctive behaviors results in frustration manifested in abnormal and destructive behaviors. Even if the environment that allows the pig to perform these behaviors is missing, it will attempt to perform them, despite the fact they do not serve any function in the present environment (4).

As the *Organic Livestock Handbook* states, "Pigs display a wide variety of instinctive behaviors such as rooting, foraging, wallowing, and nesting. A healthy environment for raising pigs is one that mimics their natural environment to the greatest degree possible, allowing the pigs to express their natural behaviors" (2).

In the *Proceedings of the Second Network for Animal Health and Welfare in Organic Agriculture (NAHWOA) Workshop*, G. van Putten from the Netherlands provides an excellent paper describing the natural behaviors of pigs. He discusses some of the various natural instincts that pigs have, and how hog producers can accommodate and work with them (3). The article is available on-line at <http://www.veeru.reading.ac.uk/organic/proc/vanP.htm>.

Nesting and Farrowing Behaviors

Pigs have the most elaborate nesting behavior of any farm animal. The sow's strongest instinct is to build a nest the day before she farrows. Sows need plenty of straw before farrowing to prepare a nest. A sow will work hard for about five hours to build a farrowing nest (3).

In nature, sows want to farrow away from the other sows. They do not want to farrow close to an older litter, or in a hut or nest that has previously had a litter in it (5). Occasionally, however, two sows may occupy a hut together. Jim Van Der Pol, a farmer in Minnesota,

explains, "These often turn out to be sisters who have slept together since birth. This is a 'black mark': We save none of the gilts from these litters for replacements, no matter how good they may be otherwise" (6). In other words, to help reduce future problems of crushing and cross-suckling of litters, this behavior is bred out of the herd. Van Der Pol also states, "'Place' is important to a farrowing sow. A day or two before farrowing, she will start to prepare a nest. For the next two weeks, she will take exception to being moved. If she decides to farrow out under the stars, we will try to move a hut to her before we try to move her to a hut" (6).

After the sow has built her nest and gone through all her preparations, she will stretch out on her side in the nest and start labor. During farrowing after one or two pigs are born, the sow generally stands up, turns around, inspects the baby pigs, and rearranges her farrowing nest. After these steps, she will go on her knees in the front end of the nest and slide herself into it again, meanwhile pushing aside the newborn baby pigs to avoid crushing them. When she is well prepared and has ample room to follow these steps, she should have a short farrowing. A short farrowing decreases the possibility of the sow picking up infections of the udder or the uterus. It also helps the baby pigs to quickly pass through the long horns of the uterus. Long farrowing often causes "blue piglets" due to lack of oxygen during the passage (3).

> ***Further comments on pasture farrowing from Jim Van Der Pol:***
>
> We want the sow to farrow her pigs with her nose close to the hut doorway. This discourages other sows from bothering her pigs, keeps the piglets warmer, and gets the sow squarely between a coyote or fox and the litter. (Although a good pasture sow is good at deterring coyotes—to my knowledge we have not lost any piglets to predators.) We also want the sow to stay with her pigs for at least twenty-four hours after farrowing before she leaves for the first time. Any shortcomings in these mothering traits are reason for culling (6).

If the sow has insufficient materials to build her nest, she may delay farrowing and/or display agitated behavior. The stress can lead to a longer, more difficult labor for the sow, and a more difficult transition to mothering her offspring (2). If unable to leave her farrowing nest, the sow frequently retains urine and feces, since soiling her farrowing nest is against her nature (3). This can also be stressful.

The first week after farrowing is important for the sow and the baby pigs. In a group-farrowing housing arrangement, no other sow will enter the farrowing nest of another sow, although the other sows show great interest in the newborn pigs. But after the first week, the sows no longer claim their farrowing nest and other sows may come in and explore or use it for defecating. After a couple of days during this first week, the baby pigs try to leave the farrowing nest, and go through considerable exertion to escape it.

One problem with systems that group-house farrowing sows is the large number of runts produced when pigs cross-suckle among simultaneously nursing sows. Because older pigs will rob milk from new litters, Greg Gunthorp, a pastured hog producer in Indiana, recommends that producers "keep age in the lot very close. The most important thing to remember when raising pigs farrowed on pasture is that the little pigs need colostrum. A sure way to fail is to allow pigs to get old enough to be running around robbing milk from young litters" (5). One option presented by G. van Putten is to transfer the sows and their litters to single pens a week after farrowing and then let them rejoin the group at a later time. He admitted that more applied research is needed to evaluate this suggestion (3).

The American Humane Association (AHA) Welfare Standards for Pigs state:

> A sow must be housed in a farrowing environment that is bedded and allows her to turn around. Farrowing crates are not permitted. Established farrowing systems such as turn-around crates, sloped farrowing pens and outdoor pastures with huts are all acceptable substitutes for the farrowing crate. Farrowing pens should be at least 5 ft. x 7 ft. 10 ft. x 10 ft. is better but a pen of this size must have at least 8 sq. ft. of protected area for piglets (zone heated) (7).

An important consideration in many farrowing environments is the problem of piglet mortality due to crushing by the sows. Studies have shown that about 75 percent of piglet deaths occur during the first three days after farrowing, and as many as 50 percent happen within the first 24 hours. There are many interacting factors that cause these first few days' mortalities, including physical trauma—being crushed, stepped on, etc. by the sow—as well as hypothermia, under-nourishment, disease, etc. (8). One study reported that about 75 percent of physical trauma to piglets occurred when the sow was standing, walking, or changing posture while getting up or lying down, especially after the sow had eaten (8).

Farm animal behaviorists with the USDA Agricultural Research Service (ARS) program "Animal Well-Being and Stress Control Systems" have been working since 1994 to find objective ways of measuring stress in farm animals to improve animal handling practices. The researchers are trying to determine whether group-farrowing conditions cause sows to be less alert to their babies' squealing. They suspect that sows may either be confused or desensitized by all the crying of other piglets in nearby litters, and thus not realize they are crushing their own squealing piglets. Sow discomfort with some types of flooring in the farrowing area can lead to a more restless sow getting up a number of times, resulting in additional crushing of piglets (9). For more information on this program visit their website at: <http://www.nps.ars.usda.gov/programs/105s2.htm>.

Make a conscious effort to select replacement gilts from mothers that thrive in your farrowing situation, selecting especially for exceptional mothering ability—how careful the sow is around her piglets, especially in the first few critical days—which is highly heritable. Jim Van Der Pol remarks:

> Will you lose more pigs in pasture farrowing than you would in crates? Yes. No. Maybe. When we moved the sows out of the farrowing crates in the early `90s, the whole operation fell out of bed. We weaned just three to four pigs per litter for the first year.
>
> But when the daughters of the original sows entered the herd the second year, the weaning average started an up-trend that has continued unabated (with the exception of a PRRS outbreak in 1998 that cost us an entire farrowing) to the present.
>
> After seven years in the pasture and straw bedded pens in winter, we wean about nine pigs per litter, which is the industry average. That's what we were doing eight years ago in crates, though the pigs were not nearly as healthy then. Our weaning average will improve as we learn.
>
> I have no doubt that there is a learning process going on between the mothers and daughters in the pasture farrowing huts that is important to farrowing success. We demonstrated that fact to ourselves last year, when a few purchased gilts immediately

> showed their lack of ability to farrow outside of confinement. Our farm will no longer purchase gilts; farm-raised replacements are a must (6).

In an article published early in 2001, researchers commented that one problem with interpreting studies that evaluate alternative production systems is that in most cases the sows were not raised in the system. The researchers knew of only one study that used sows raised in the alternative system being evaluated, and that study showed that sows familiar with the system do much better than those newly brought into the system. In concluding, the researchers stated:

> In summary, piglet mortality in different alternative systems varies widely. However, recent developments in the design of farrowing pens, management strategies, and the use of hybrid systems appear to have reduced piglet losses in non-crate systems. Although it is important to ensure that the welfare of both the sow and the piglet are maximized in alternative farrowing systems, it should be acknowledged that piglet mortality during the first few days post-partum is an issue equally as important as sow welfare. Some compromise with issues of sow housing may be required to achieve a realistic outcome (8).

In short, the challenge is to find the alternative system that permits natural nesting behavior, while maintaining low piglet mortality.

Rooting

Allowing the pig's natural rooting behavior to be expressed plays an important part in reducing its daily stress level. According to A. Stolba (10), about 51 percent of a pig's time is spent rooting—understandably, since the pig's sense of touch is mainly located in the snout's rooting disc, a floating mass of cartilage tied to muscles allowing the pig to move the disc freely, where E. D. Adrian counted as many tactile organs as humans have on the palms of both hands (11).

Pigs will start rooting the first day they are born. They can most easily satisfy their rooting instinct when provided with deep-litter bedding or access to pasture. If confined in small paddocks, rooting pigs can be used to clear land of prickly briars and bushes. However, pigs occasionally damage a permanent pasture, especially when overstocked, or during wet weather when the sod starts breaking up under their feet (see **Physical Alterations—Ringing of Sows and Pigs** for more information). As Greg Gunthorp comments, "Pigs would make an excellent addition to a farm for pasture renovation. Pigs can be extremely rough on pasture. Why not use unrung pigs on poor pasture instead of a plow. Then just level and reseed" (5).

The AHA Welfare Standards for Pigs state, "Pigs are naturally inquisitive and must at all times have access to straw or other suitable media such as wood chips or sawdust for the expression of rooting, pawing, mouthing and chewing behavior" (7).

The Animal Welfare Institute's (AWI) Humane On-Farm Husbandry Criteria for Pigs require that:

> Pigs shall have continuous access to pens bedded with straw or chopped corn stover, or pasture or dirt yards in which they can root, explore, play or build nests. Substitutes for straw and corn stover may be used only with the approval of the Animal Welfare Institute. Straw is the preferred bedding for farrowing sows and their nursing piglets.

> Even when bedding is not needed for warmth, straw or other approved materials shall be provided to hogs that do not have continuous access to pasture or dirt. The bedding shall be provided in quantities sufficient to give the hogs material to play, explore and root (12).

A Word on Bedding

Section 205.239 of the NOP Final Rule states that producers must provide appropriate clean, dry bedding to maintain livestock living conditions that accommodate the health and natural behavior of the animals. It also states that if the animal typically consumes the bedding, the bedding must meet the feed requirement of Section 205.237. Because hogs consume some of their bedding at various stages of their life, the bedding requirement will need to be evaluated.

Pigs should have some type of bedding at all times when not on pasture, especially in cold weather, when they need plenty of bedding to make a warm and comfortable bed. Often they will huddle together, so even if the temperature in the sleeping area is low, the pigs will be comfortable.

Types of organic bedding that can be used in most stages of the pig's life include small-grain straw, chopped or baled corn stalks, soybean straw, low-quality grass hay, whole or ground corn cobs, etc. (Whole or ground corncobs, however, are too abrasive for small pigs.) Sawdust, peat moss, or other dusty materials are not suitable for pigs because the dust is very irritating if inhaled while the animals sleep (3).

The producer needs to use caution if wood shavings or other wood products are used as bedding material for finishing pigs or gestating sows. The following warning is included in the publications *Hoop Structures for Grow-Finish Swine* and *Hoop Structures for Gestating Swine*.

> Wood shavings and sawdust need to go through a heat cycle to avoid the transmission of avian tuberculosis to the pigs or sows. Unless wood product residue has gone through a heating process, there is a risk of carcass condemnation at slaughter (13).

Pigs are naturally clean animals and rarely soil their bedding if given an opportunity to leave their sleeping area. During the winter, pigs might not want to go outdoors, so it may be necessary to chase them out of their sleeping areas early each morning to train them to use a separate dunging area (2).

Producers must pay attention to the ears of the pigs during cold and windy winter conditions. The large ears of many breeds have poor blood supply. The ears can get frostbite or long-lasting wounds, causing considerable pain to the hog (3).

Wallowing

Pigs are the only farm animals that are unable to reach their entire body for licking and grooming (3). They also have poor heat regulation systems because of their thin hair cover and their inability to sweat except through their mouths (14). So, in order to help clean their hair and skin, get rid of external parasites, and regulate their body temperature, pigs take a mud bath or wallow. Wallowing also provides protection from sunburn, which usually first affects

the skin behind ears and udders (14). After the mud bath, the pigs rub the dried mud off on trees, posts, etc.

The pig's instinctive urge to wallow can cause some problems for the producer, however. Mud holes can spread parasites, because pigs eat and drink from the muddy water. G. van Putten suggests:

> On hot days, we could offer showers to the pigs we are looking after. After warning the pigs with a special sound (buzzer, bell, or horn), all pigs wanting to participate will arrive at the showering area. We also should install rubbing brushes, solidly attached to a wall or post, positioned in such a way that the sows or fattening pigs can rub both their sides and their backs. They will really enjoy that, with the consequence that these rubbing brushes will have to be replaced three times per year! After all, why do we consider rubbing brushes normal equipment in a cow house and never consider them at all in a sow house (3).

Nonetheless, producers need to keep in mind that mud is more effective than clean water in temperature control because pure water evaporates fast. Mud retains moisture longer and the evaporation process continues for a longer time. In the book *Outdoor Pig Production*, Keith Thornton suggests making a wallow bath out of galvanized steel sheeting, with an attached covered service box controlling the water supply. The specially constructed wallow would measure about 4½ x 6½ ft., and be about 10 inches deep (14).

According to the AHA Welfare Standards for Pigs, "For summer conditions, provisions must be made to protect pigs from heat stress. Wallows, shade, evaporative coolers, drippers, cooling mats, misters and fans are all acceptable...Extra space may be required to allow pigs to lie apart in hot conditions...to maintain the pig's temperature below upper critical levels" (7).

Foraging

For pigs, foraging behavior is a social activity, so that when food is found, all group members eat at the same time. "One can imagine how the pigs feel if they know that some other pigs in the same house are eating, and that they have no chance of leaving their pen and joining in the meal" (3). Even when given all the feed they need, pigs still display a strong need to forage. This frustration is manifested as sham chewing and other indications of poor welfare. "Providing an abundant supply of unopened straw bales or ad lib feeders, which require sows to manipulate controls in order to receive their feed in small increments, can help the pigs satisfy their need to keep the mouth active even in the absence of hunger" (2).

The AWI Criteria for Pigs suggest that all animals have a feeding plan that guarantees a sufficient, varied, and well-balanced diet. They should also have access to their feed as long as necessary to satisfy feeding requirements. The criteria also state that skip-a-day feeding for breeding animals is not allowed—all pigs must be fed daily. Furthermore, housing and distribution of feed should be designed to minimize competition for food (12).

The AHA Standards for Pigs require that all pigs not allowed to satisfy their hunger fully at least once a day must have access to straw or other foraging material. They state that a plan must be in place to supplement the diet by adding bulk or a suitable rooting material. Forage fulfills this requirement for outdoor-housed pigs. The standards also state that sows must be

fed in ways that avoid bullying, that pigs may be fed on the floor as long as the surface is dry and clean, and that individual feed consumption should not be limited by social competition (7).

Pastured Pork Production

Greg Gunthorp defines pastured pork production as hogs raised on grass, legumes, standing crops, or any other ground cover. Farms that have hogs on bare ground are not pastures, just outdoor hog operations. The bare-ground outdoor operation is simply exchanging feed for building costs, without considering the lower feed costs possible with pastures, or the pollution potential from having too many hogs on bare ground (5).

The Farm Animal Welfare Council (UK) has concluded that "outdoor pig keeping can be successful and has the potential to provide all the conditions required for good welfare. However, the achievement of these conditions is dependent on high stockmanship, good management, site selection, and the right choice of stock" (8).

With good management practices, pasture-raised pigs come close to being the easiest system for meeting organic requirements. A pasture grazing system is a seasonal system that can work well in most weather, providing that the producer continually monitors and manages the hogs' comfort and stress levels. Breed selection is important, since there is great genetic variation among pig breeds in ability to utilize forages.

When pigs are on pasture, the producer needs to monitor the quality and condition of the pasture forage. Good forages usually contain more protein than grains, but have lower protein digestibility than soybean meal or other protein supplements. The pig's digestion of forage fiber improves as the pig matures; the pig can absorb more of the forage's nutrients after an adaptation period of at least two months. Nearly all the forage fiber is digested by fermentation in the large intestine. Unlike sheep and cattle, pigs are not physiologically suited to eating great quantities of forages, but a sow can gain a large portion of her nutritional needs from good-quality pasture. Hogs also differ from ruminants in that they require forages in earlier stages of maturity (15).

Jim Van Der Pol comments:

Farrowing sows can be an asset in managing to improve pastures. Sows clip the sward short in addition to supplying manure, thus doing a fine job of preparing the pasture for an overseeding of alfalfas and clovers. We spin seed while the sows have two weeks left in the pasture (third week of October), but late enough that the seed will not grow in the fall. The next spring will see an explosion of new legume growth.

Two things are happening here. First, the sows are treading in the seed. We get better germination this way than with frost seeding. Second, because the grain is carried to the sows, fertility is being added to the soil. Our soil tests in the farrowing paddocks show P and K levels four and five times higher than in adjacent new seedings; nutrient buildup is not a problem yet (6).

Researchers have found that feed savings for pigs on pastures vary greatly depending on pasture quality, type of forage, age of the pigs, and management system. Studies indicate that 3 to 10 percent of the grain and as much as 33 percent of the protein needed by growing and finishing pigs can be met by pasture (16).

Pasture raising of hogs can also fit with annual rotations that include a variety of crops. Brassicas—such as turnips, rape, kale, fodder beets, and mangels—are all high in protein and digestibility, and make excellent pig forages. Hog pastures can also include self-harvested grain crops. This practice is called "hogging off" the crop. Advantages of hogging off are reduced harvest costs, manured fields, and fewer parasite problems.

> ***Greg Gunthorp's pasture hog hints:***
>
> Have plenty of high quality legume pasture. Frost seed clovers and alfalfas every year if you have to. Pigs love clover, alfalfa, chicory, rape, turnips, and short vegetative grass. Pigs aren't ruminants. They won't bloat on pure stands of alfalfa or clover. Pigs won't gain weight on pasture without grain. Sows can maintain weight on a very high quality legume pasture without grain. Genetics differ greatly in their ability to utilize forages and fiber. Colored breeds are much better (5).

Some plants can be poisonous to hogs. These include pigweed, Jimson weed, two-leaf cockleburs, young lambsquarters, nightshades, buttercup, tarweed, St. John's wort, and water hemlock. Other plants can also be toxic to pigs, depending on the amounts eaten. Your veterinarian and the county Extension agent should be able to help with weed identification.

When pigs have sufficient pasture, their manure is usually dispersed sufficiently to not require any additional handling. With proper rotation of pastures and selection of pastures away from steep slopes, streams, or drainage ways, there is minimal risk of soil or water pollution from direct runoff of the hog manure.

Again, it is important to chooses hardy breeds that will perform well on pasture. For example, pigs with dark skin and/or full coats of hair are less prone to sunburn than are white or less hirsute breeds, and a medium-framed hog with larger lung capacity is generally better suited for a pasture operation than a larger, narrow-bodied hog.

Pasture Farrowing

The most common pasture production system involves rotating gestating sows among various pastures. At farrowing time, the sows are moved onto new pasture with a farrowing hut for each sow, where the sows and litters will stay until weaning. The farrowing huts are important to provide the baby pigs a place that is dry and protected from drafts. In cold, wet, and muddy pasture conditions, additional bedding should be used in the huts (see p. 9 for more information on bedding). An Iowa study evaluated crushing-mortality rates in 7 different styles of farrowing hut and determined that larger huts, with the door in the corner and space for baby pigs to be protected from the sow, had fewer pig crushing losses (17). Some plans and pictures of one type of farrowing hut are available at the Practical Farmers of Iowa website: <http://www.pfi.iastate.edu/EHUT%20Farrowing%20Pix.htm>.

A pasture farrowing system requires portable housing, feeders, waterers, and a fencing system—usually electric fencing. Whether building or purchasing the huts, feeders, etc., the producer needs to remember that treated lumber with arsenate or other prohibited materials that come in direct contact with animals is prohibited (see **Treated Lumber** section below for more specific information and alternatives).

Depending on the number of sows farrowing, the bedded farrowing huts need to be spread over a large area with the huts separated by sufficient distance to reduce contact among sows and litters as much as possible. Jim Van Der Pol reports that he sets huts at least 50 feet apart. Providing more huts than sows allows the animals additional choice and is recommended. Van Der Pol suggests that the waterers be set well away from the huts, so that no sow can drive the others away. Waterers should always be placed in direct sunlight to discourage sows from lying in front of them for a long time. Placing the huts in a large circle around the waterers and feeders is a good strategy.

Appropriate stocking rates will vary according to location and season, so they need to be evaluated occasionally to maintain satisfactory pasture conditions. Using an optimum stocking rate and rotating pastures can help reduce the build-up of parasites and diseases, and provide opportunity for regrowth of forages.

Greg Gunthorp notes that 8 to 10 sows per acre is a reasonable stocking rate for his area of Indiana (5). Jim Van Der Pol states, "Stocking rate runs about nine to eleven sows per acre of good pasture for the growing season, though this gets a bit heavy for our western Minnesota land in September. This holds both for rotated gestating sows and set-stocked sows and litters, as the sows with litters are getting more grain" (18).

The Pork Industry Institute at Texas Tech University uses two farrowing radials, each with 12 one-acre lots in a pasture rotation system with a continuous inventory of sows. Each paddock contains from 0 to 10 sows at any one time. Usually a paddock is used for 4 weeks to house six sows and their litters. The paddocks are given a 3-week rest before the next group of sows is moved in. In a study, they found that after 18 months of use the farrowing paddocks maintained or even increased percentage of ground cover and slightly reduced percentage of weeds (19).

It is important for gestating sows to have some access to a concrete area in order for the sows to abrade their hooves. If they don't have access to concrete, the hooves may need trimming (a very difficult task for pigs) (3). The AHA Standards for Pigs suggest that, "Close attention must be given to the condition of the feet, which must be regularly inspected for signs of abnormal wear, excessive growth or infection" (7).

Greg Gunthorp recommends that producers keep the farrowing date for all sows in each pen as close as possible (10–14 days when weather is cool enough to keep baby pigs from running all over, and maybe only 4 days when weather is hot). He says that temporary electric fencing can be used to temporarily separate the older litters from the younger ones in the pasture (5).

Iowa State University researchers found that overall, the fixed costs of Tom Frantzen's pasture farrowing operation for nearly 100 sows were 30 to 40 percent lower than for confinement systems, and that the total costs for sows were about 5 to 10 percent lower on the pasture. Frantzen has estimated that it costs him only about $15 to produce a 40–pound pig. He states,

"You aren't going to see high production per pig per year when you're pasturing hogs, but profit per acre is very high. That's what we should be looking at anyway" (20).

The *Organic Livestock Handbook* comments,

> Early exposure to pasture is reported to boost immunity levels in piglets, while the exercise obtained in open fields promotes health. Producers using pasture report the lowest health expenses, although one study showed those using a mix of facilities had the highest, suggesting that pigs may have difficulty adjusting from one system to another (2).

Pasture Finishing

It is certainly possible to finish-feed hogs on pasture, especially when grain crops are provided for hogging off. Greg Gunthorp suggests that stocking rates for pasture finishing market hogs vary from about 15 to 75 pigs per acre depending on their weight, with the rates per acre going up if management intensive grazing (MIG) is utilized. He provides many suggestions on how to use electric fencing to keep the various sizes of pigs in the pasture, and to help keep the pigs from shorting out the electric fencing when they dig or root along the fences. Gunthorp further states that "grazing corn is by far the best pasture for finishing pigs." He suggests supplemental strip grazing of rape and a high-protein corn. For more specific information on fencing, feeding, or managing pasture-finished pigs, see Gunthorp's website at: <http://www.grassfarmer.com/pigs/gunthorp.html>.

Additional information on pasture farrowing, outdoor hog production practices, and fencing hints and considerations are available from the following sources:

- The University of Minnesota Extension book, *Hogs Your Way: Choosing a Hog Production System in the Upper Midwest* (21), describes pasture production systems, and includes Jim Van Der Pol's and Tom Frantzen's on-farm pasture production experiences. On-line at: http://www.extension.umn.edu/distribution/livestocksystems/DI7641.html

- Arkansas State University Pasture Based Swine Management site: http://www.clt.astate.edu/dkennedy/index.htm

- Texas Tech University Pork Industry Institute site: http://anm123c-1.asft.ttu.edu

- The pastured pig article series by Jim Van Der Pol in the magazine *Graze* (22)

- The Iowa State University Sustainable Agriculture publication, *Swine System Options for Iowa: Outdoor pig production: an approach that works*. On-line at: http://www.extension.iastate.edu/Publications/SA9.pdf

- Article from *The New Farm* at: http://www.awionline.org/farm/frantzen.html

Housing Considerations

The *Organic Livestock Handbook* comments: "Research has found that the type of housing selected for pigs plays a major role in the health of the herd, influencing such things as social behavior, feeding and weight gain, and rates and degree of health problems" (2). Group housing systems for pigs need to allow for social behavior and for avoiding unnecessary social stress. Pigs are very social animals and live in family groups in their natural environment. In these family groups, the sows establish their hierarchy—ranking by age, size, and aggressiveness. "Maintaining sows in individual family groupings throughout all stages of production minimizes confrontation, fighting, and the possibility of real injury, which occurs if newcomers are continually introduced to the social circle, disrupting the hierarchy" (2).

Sows need at least a couple of weeks to establish social groups that have sufficient stability to provide support to members and reduce stress (3). One study has shown that although frequent mixing of gilts resulted in the same amount of threatening behavior, the number of injury-causing fights could be significantly reduced by regrouping the gilts at least three times (3).

Jim Van Der Pol explains:

> Sows have a strict social structure. We can understand much of what happens by knowing the dominant and submissive sows, and how they act. The dominant sow can usually be found in a gatekeeper position, closest to the waterer or feeder. The most submissive will farrow in the farthest corner. Every other sow fits between. Knowing something of the social ladder can help when deciding which sow of a twosome to move, and which to leave, should a problem arise (6).

Providing sufficient watering and feeding space is necessary in all housing options. The AHA Standards for Pigs set the following requirements for a feeding place (space required by a single pig while eating). When ration-feeding pigs in a trough, there must be 1.1 times the shoulder width for all of the pigs, so that they can feed together simultaneously. There must be no more than 6 pigs per feeding place when using a dry feeder without full head barriers for each feeding place; 10 pigs per feeding place where there is a full head barrier; and 14 pigs per feeding space in wet and dry feeders (an additional waterer must also be supplied in the pen). There must be one drinking space provided for each 10 pigs, with the waterers adjusted in both height and flow rate to ensure that water is accessible for each pig (7).

Space Requirements

The USDA organic rules do not establish any space requirements for livestock living conditions, but state that a producer must accommodate the health and natural behavior of the animals. However, they also state that, "We anticipate that additional NOSB [National Organic Standards Board] recommendations and public comment will be necessary for the development of space requirements."

According to the AWI Criteria for Pigs, space requirements for animals that are not free-ranging on pasture may vary according to the design of the indoor or indoor-outdoor housing system. The following minimum space requirements are based on Swedish experience, particularly

experience with housing boars, gestation sows, and sows with litters in the Swedish Thorstensson and Ljungstrom versions of deep-bedded pig housing.

1) Boars: 64 sq. ft. per individual (74 sq. ft. if no separate dunging area provided);
2) Sow and litter in pens:
   pens with manure gutter: 54 sq. ft. exclusive of gutter per sow and litter;
   pens without manure gutter: 64 sq. ft. per sow and litter;
3) Sow and litter in boxes: 48 sq. ft. per sow and litter;
4) Sow and litter in group lactation housing: 81 sq. ft. per sow and litter;
5) Gestating and mating sows (individual housing in crates is prohibited; the following requirement is for group-housed sows): 27 sq. ft. per sow (exclusive of feeding area);
6) Weaned, growing and finishing pigs: Space shall be provided to allow all pigs to lie down in full lateral recumbency at the same time. This minimum does not take account of other needs to move about and socialize and this minimum may need to be increased if new information warrants an increase (12).

The AHA Standards for Pigs provide a table that lists the minimum bedded space allowance for growing pigs from 1.6 sq. ft. per 22-pound pig to 8.1 sq. ft. per 220-pound pig, with a minimum total floor space of 37.6 sq. ft. per adult sow. They state that pigs must always be provided with total floor space no less than 1.5 times the lying space (should at least be equal to the square of the length of the pig) (7).

Access to Outdoors

Depending on how the USDA regulations ultimately define access to outdoors, shade, shelter, exercise areas, fresh air, and direct sunlight for hogs, the new definitions will determine how housing and production systems will have to be re-designed or modified to meet the requirements for certification. Will the USDA require a pasture lot, open dirt lot, or cemented area outside the various buildings for exercise? Or will a building with an open front and back that allows sunlight and fresh air to enter be sufficient access to outdoors? If the requirements are defined so that access to outdoors means pens or lots outside buildings, these will have to be designed to prevent soil and water pollution through manure runoff.

Swedish Deep-Straw Farrowing System

The Swedish deep-bedding group and nursery system was developed in the late 1980s to comply with Swedish laws that ban sub-therapeutic use of antibiotics in livestock feed and that enforce strict animal welfare laws. The system provides a more natural, reduced-stress weaning environment that allows for an all-in/all-out production system, incorporates a longer nursing period, and allows for natural nesting behavior. Producers using this system will need to incorporate a separate finishing operation, such as pasture, hoop shelters, or other type of finishing facility.

Deep bedding (consisting of 14 to 18+ inches of organic materials that will absorb moisture and slowly compost) is an essential part of the system. Producers in Sweden figure about 2 tons of straw (about 5+ large round bales of wheat, oat, or barley straw) per sow per year. Corn stover may be used in gestation group pens, but is not suitable for nursing rooms. Any substitution for baled straw may affect stocking rate (such as spacing needed per sow) and manure management, as well as composting rates. Insufficient straw may cause the deep bedding to not

compost properly and become anaerobic (lack of oxygen or too high a moisture content may cause bedding to become cold, damp, and smelly, which is unhealthy for the pigs).

The Swedish system is designed around a well-insulated, naturally ventilated barn that incorporates all aspects of the gestation, farrowing, and nursery with easy movement of sows and/or pigs between rooms. Eight to twelve sows form stable groups that move through the building from breeding to gestation, farrowing, weaning, and back to breeding.

The stable groups of sows stay in deep-bedded group gestation rooms with a minimum of 27 sq. ft. per sow plus the area of a feeding stall that can be closed behind the sow. (This compares to about 14 sq. ft. for gestation stalls used in many conventional U.S. gestation barns.) The group gestation rooms allow sows nose-to-nose contact with the boars in their pens and can function with both hand mating and/or AI. Adding individual females to stable groups is accomplished at several specific times in the farrowing cycles.

Ljungstrom and Thorstensson are two different versions of the Swedish Vastgomodel system. In both these versions, the sows farrow in a farrowing-nursing room with at least 81 sq. ft. of deep-bedded area and 14 sq. ft. of raised feeding area per sow. In the Ljungstrom version sows are farrowed in deep-bedded pens (64 sq. ft. or more) in a farrowing room. The sows and litters are later moved to a common deep-bedded nursing room when the piglets are about two weeks old. In the Thorstensson version, the sows are brought into a deep-bedded nursing room a couple of days before farrowing. The nursing room is set up with wooden farrowing boxes or cubicles (48 to 64 or more sq. ft.) with rollers in the entrance to help keep piglets in boxes, but allow sows to come and go. As the sow nears farrowing, she chooses a farrowing box, starts her nest-building, and farrows. After about a week, or after the baby pigs start climbing over the entrance rollers, the farrowing boxes are removed and the litters are allowed to commingle. It is important in both of these versions to have the sows all farrow in the nursing room within a short time span (one week or less).

When the litters are about 5 to 6 weeks old, the sows are removed from the nursing room and returned to gestation rooms for rebreeding. The weaned piglets stay in the same nursing room until they are about 50 to 60 pounds (about 11 to 12 weeks old) and are then moved to a separate finishing facility. At weaning time, the piglets should have learned how to eat solid food at their mother's side.

The Swedish system can probably be made to meet any of the requirements for organic certification. However, as described above, the gestating sows are housed in deep-bedded pens, and the farrowing sows and litters are all kept in the common deep-bedded farrowing and nursing rooms for 9 to 12 weeks *without access to outdoors or direct sunlight*. This may not be a problem during bad or inclement weather, but for other circumstances this system will need to be evaluated.

Additional information on Swedish Deep-Straw Farrowing is available from the following sources:

- The University of Minnesota Extension book, *Hogs Your Way: Choosing a Hog Production System in the Upper Midwest* (21), describes the Swedish system, as well as Nolan Jungclaus's and Dwight Ault's on-farm Swedish system farrowing experiences. On-line at: http://www.extension.umn.edu/distribution/livestocksystems/DI7641.html

- Iowa State University Sustainable Agriculture publication SA 12, *Swine System Options for Iowa: Swedish deep-bedded group nursing systems for feeder pig production*. Available from the Iowa State University Extension Distribution Center (23)

- Conference proceedings on background and behavior considerations in Swedish deep-bedded systems, at: http://www.ctic.purdue/edu/Core4/nutrient/ManureMgmt/Paper41.html

- Conference proceedings on breeding herd management and performance in Swedish deep-bedded systems, at: http://www.ctic.purdue/edu/Core4/nutrient/ManureMgmt/Paper34.html

- Article on Dan and Colin Wilson's deep-bedded Swedish system, at: http://www.ctic.purdue.edu/Core4/Nutrient/ManureMgmt/Paper38.html

- Article on the Swedish system from *The New Farm*, at: http://www.awionline.org/farm.bowman.html

Deep-Straw Hooped Shelters

Developed in Canada as alternative housing for hog finishing, hooped shelters are arched metal frames, secured to ground posts and side walls about 4 to 6 ft. above ground level and covered with a polyethylene tarp that is stretched and secured (it is easy to accidentally tear a hole in the tarp, but the tear can usually be patched with a special polytape available from the shelter manufacturer). The hooped shelters come in various sizes, but a typical size is 30 ft. wide by 60 to 80 ft. long. At 12 sq. ft. per pig, the capacity of a 30 x 80-ft. structure is 200 hogs, or 150 hogs in a 30 x 60-ft. structure. The end walls have moveable closings made with plywood doors, tarps, etc. The shelter's ends are left open most of the year for ventilation; the end openings are adjusted appropriately in winter to reduce wind and cold while maintaining fresh air and reducing humidity levels. Erecting end wall closings can be difficult, however, because the end pipes of the shelters cannot be used for support (24). Many producers have added 16-ft. steel hog gates on both ends of the shelter to allow for easier entry for regular additions to bedding and for cleaning out manure.

Most shelters are laid out north by south or a bit northeast by southwest to help catch the prevailing summer breezes. On the south end, a concrete pad (usually extending 16 to 20 ft. into the building, or about 1/3 of the hoop depth) runs the full width of the shelter. It holds the feeders and usually two heated or energy-free, freezeless waterers with two watering holes each. The slightly outward-sloping pad is typically 6 to 15 inches higher than the rest of the building. The inside edge of the concrete pad should have a downward curb of at least 12 to 16 inches to help keep pigs and manure-loading equipment from undermining the concrete over time. There may be several gates and/or fencing on the inside edge of the pad to restrict the hogs to an opening on each end of the concrete pad and to help separate the dunging area and sleeping area from the feed and water area.

The remaining two-thirds of the shelter is a dirt floor covered with deep bedding of straw, corn stalks, hay, etc. The back third of the shelter is generally the dry sleeping area, while the middle

third is where the pigs dung. The two-thirds of the shelter that is dirt floor is all deep-bedded. Some manure scraping or removal from the concrete pad may be necessary with certain groups of hogs. If the shelter is equipped with some sort of divider or has a front alleyway that the hogs can be moved to, the manure can be removed from soiled areas almost anytime with a skid-loader or a tractor loader equipped with a grappling fork. Some producers with smaller groups of hogs have split the hoop into two pens by building a solid partition down the length of the hoop.

In hooped shelters, 12 to 15 sq. ft. of space per finishing pig is recommended. Feeder pigs are moved to the shelter when they weigh 30 to 65 pounds, and are left until they reach market weight. Feeder pigs should be larger when moved to the shelters during the winter months, so that they can better tolerate the stress. It is very important to have ample bedding available at all times.

As with the Swedish system, deep bedding is the key to hoop shelter performance. Deep bedding consists of 14 to 18+ inches of materials, such as small grain or soybean straw; baled cornstalks; grass hay; ground corncobs; rice hulls; or a combination of various types of organic material that will absorb moisture, slowly compost, and help keep the pigs dry and warm. There is no supplemental heat added to deep-bed hooped shelters, so the wintertime air temperature in the hooped shelter is only about 15°F warmer than it is outside (25). However, even with winter temperatures near -20°F, a probe placed in the bedding in the sleeping area may register near 100°F.

In several Canadian trials, the amount of barley straw required was 194 pounds per pig for the summer, 242 pounds per pig for the fall, and 363 pounds per pig for the winter (24). When corn stalks are used, each group of 150 to 200 pigs requires at least 30 big, round bales of corn stalk bedding. At cleanout time between groups of pigs, there are about 3,000 bushels of deep bedding and manure that can be composted further and/or directly applied to fields.

If the manure is hauled directly to the field, the application rate should be determined by the nutrient content of the manure and the soil and crop needs in the field. This can be accomplished with manure and soil testing. Proper adjustment and calibration of the manure spreading equipment is important to assure accurate application. Nutrient crediting for the manure—taking into account the nutrients contained in the manure when planning fertilization—can lead to significant reductions in fertilizer purchases. The manure application rate is usually based on the nitrogen needs of the crop. But be aware that manures may contain high levels of phosphorus and potassium, which could lead to excessive buildup of these nutrients in the soil over several years. The producer can address this potential problem by adjusting the manure application rate to meet the phosphorus needs and using alternative means to supply additional nitrogen. ATTRA's *Sustainable Soil Management* provides additional information on assessing soil health and needs. More information on field application of manure is available in ATTRA's *Manures for Organic Crop Production*.

In 1998, Iowa State University researchers examined the distribution of moisture, nitrogen, and the temperature of the deep-bedded pack inside a hoop shelter to evaluate the high degree of variability in the bedded areas between the sleeping and dunging areas. They studied the effects of four different composting strategies on the manure's nutrient levels and uniformity,

mass, volume, and moisture content. The study is available at their website: <http://www.extension.iastate.edu/Pages/ansci/swinereports/asl-1595.pdf>.

Composting is one way of stabilizing the manure's nutrient content and reducing the bulk of the material hauled to the field. Composting is a natural process relying on aerobic microbial activity and decomposition. Well-made compost is usually free of weed seeds and pathogens, and has virtually no potential to burn plants, regardless of application rate. When applied to the soil, compost increases biological activity, improves tilth, and increases the availability of certain plant nutrients already present. Compost also contains nutrients that are more readily available to the plants and are held against loss through leaching and volatilization.

Almost any organic material can be composted if the proper C:N ratio, moisture content, and aeration are maintained. However, making good compost is an art as well as a science. Compost, like manure and soil, should be analyzed by a laboratory to insure nutrient value. On-farm composting will require additional labor and management, as well as additional equipment for turning the compost. For more information on composting, request ATTRA's *Farm-Scale Composting Resource List*.

In recent years, hooped shelters have also been used for gestating sow housing. The hooped shelters for sows are the same basic hoop structures used for finishing hogs, but with different floor designs and additions for better management of the gestating sows. The size of the hoop structure, the design of the floor plan, and the feeding options (feeding stalls, self-feeders, or other feeding arrangements) for the gestating sows will depend on the needs of the producer to meet the organic requirements.

As with the Swedish system, the hooped shelters for finishing and gestating sows can probably be made to meet any of the requirements for organic certification. However, as described above, the gestating sows are housed in deep-bedded pens in the hooped gestation barn and the finishing hogs are without direct access to outdoors, even though the two ends of the building are open, providing fresh air and sunlight in part of the hoop structure. This may not be a problem during inclement weather, but for other circumstances the hooped shelters will need to be evaluated.

The Swedish deep-straw farrowing system and the deep-straw hoop shelters have all been designed, researched, and evaluated without allowing any direct access to the outdoors. Will allowing access outside of these structures change the dunging and sleeping areas sufficiently to reduce the deep-bedded composting aspect of these systems? How the access to outdoors is reconciled with the use of deep-bedded systems will be critical to organic pork production, especially in colder, harsher climates.

Additional information on hooped structures is available from:

- ATTRA's *Hooped Shelters for Hogs* publication at: http://www.attra.org/attra-pub/hooped.html

- The University of Minnesota Extension book, *Hogs Your Way: Choosing a Hog Production System in the Upper Midwest* (21), which describes the deep-straw hoop structure system, as well as Mark Moulton's, Roger Hubmer's, and Dave Struther's on-farm deep-straw hoop

structure experiences. On-line at:
http://www.extension.umn.edu/distribution/livestocksystems/DI7641.html

- Publications AED-41 *Hoop Structures for Swine Housing* and AED-44 *Hoop Structures for Gestating Swine*, available from Midwest Plan Service (MWPS) (26)

- Article "Gestating sows in deep-bedded hoop structures" at:
http://www.extension.iastate.edu/Pages/ansci/swinereports/asl-1496.pdf

More Traditional Types of Open Buildings and Lots

A Cargill-style unit is one example of a traditional building. Divided into 10 pens, it has an 18 x 120 ft. monoslope bedded shed and 30-plus ft. of outside sloped concrete area for the feeders and waterers, with a total building capacity of around 400 hogs. Also traditional are concrete lots or dirt lots with various types or shade or shelter. All of these may be adapted to organic hog production. These can all be made to work with proper management and the use of bedding materials, but organic producers will need to carefully consider which option is best for their specific circumstances. Some of the many factors that producers need to consider in making this decision are available in the publication from Iowa State University entitled *Open vs. Enclosed Swine Finishing: Making the Decision*. (It includes an interesting table on how feed intake and the pig's maintenance energy level varies with various temperature conditions.) This extension publication is available at:
<http://www.extension.iastate.edu/Publications/PM1608.pdf>.

The Cargill unit and other open-lot systems that use bedding are generally designed to handle manure as a solid. However, since these units are open to rain and snow, they should be sloped to assist drainage and runoff collection, as well as to divert water away from the open lots. These systems are scraped frequently to reduce the buildup of manure solids and to avoid odor and fly problems. The scraped solids can either be composted or directly applied to the fields. All manure and/or runoff from these open systems needs to be managed properly to avoid the possible contamination of any crops, soil, or water.

The Cargill unit and other open-lot systems are more difficult to manage than deep-bedded systems, especially in ways that minimize the environmental stress of winters in northern climates. The pigs' performance and comfort levels will generally be lower in these systems, which may lead to health problems and other problems that may be difficult to manage organically.

Treated Lumber

The new USDA organic rule prohibits "the use of lumber treated with arsenate or other prohibited materials for new installations or replacement purposes in contact with an organic production site." This prohibition applies to lumber that will come into direct contact with livestock, "such as the boards used to build a farrowing house."

Historically, restrictions on treated lumber have been addressed differently among different organic certifiers. It has been common to permit the use of pressure-treated wood, if it was

adequately covered with tin or some other material to preclude direct contact. Whether or not such strategies will be permitted under the Final Rule is undecided at this time. It is expected, however, that installations existing on currently certified farms will be "grandfathered in" when and if their certifying agent becomes NOP accredited. Of course, any future changes to those installations and any new construction will have to conform to the restrictions and requirements of current legislation.

There are a limited number of alternatives available that can be used in place of pressure-treated lumber and treated exterior plywood. These alternative wood treatments are free of arsenic, chromium, or other EPA-classified hazardous preservatives. But remember that none of these alternative wood preservative treatments have yet been evaluated or approved by the NOSB.

Borates (boric acids and borax) have been used for alternative wood protection for many years. Borate-treated lumber and borate wood treatments are available commercially. The Bio-Integral Resource Center (BIRC) published an article entitled "Borates for Wood Protection" in the March 1998 *IPM Practitioner* (Vol. 20, No. 3, p. 1–12). The article provides a history of the use of borates, reviews borate protection against various pests and decay, and lists resources for borate-treated wood, wood protection products, and applicators (27).

The following wood preservative was developed by the USDA's Forest Products Laboratory to protect wood and the recipe was published in the magazine Cognition in 1993, in an article entitled "Pressure-Treated Wood: Is It the Right Kind of Green?" Remember that before using this recipe, it is necessary to check to make sure that these ingredients are all NOP approved.

Ingredients:

1½ cups boiled linseed oil
1 ounce paraffin wax
Enough solvent (distilled pine tar, turpentine, etc.) at room temperature to make the total volume of the mix 1 full gallon

Directions:

Melt the paraffin over water in a double boiler. Do not heat over a direct flame. Away from the heat source, stir the solvent vigorously, and then slowly stir in the melted paraffin. Add the linseed oil and continue to stir thoroughly. Apply by dipping the untreated lumber in the mixture for three minutes or by brushing on a heavy application. The wood can be painted when it is thoroughly dry.

Cautions and suggestions:

This solution is flammable, so all mixing should be done outdoors. Wear gloves, avoid breathing the vapors, and avoid contact with face and eyes. It may separate when cool; if so, just warm the mixture to room temperature and stir. Like many other finishes, it may need to be reapplied every few years.

NCAT Center for Resourceful Building Technology (CRBT) (28) promotes environmentally responsible practices in construction. They identify and promote building products and methods that reuse salvaged, currently underutilized, or waste materials, and produce less pollution and waste than conventional materials and technologies. They have an excellent, searchable *Guide to Resource Efficient Building Elements* at <http://www.crbt.org> that provides information on many alternative building materials, as well as information about the manufacturers.

One commercial wood preservative product, DUBNO® oil primer, should be covered with KALDET® stain; both contain only biological and environmentally responsible ingredients, and are free of lead, arsenic, mercury, and cadmium. More information is available at <http://www.livos.com> or from LIVOS Phytochemistry of America, Inc. (29).

Preserve® wood products are treated with Alkaline Copper Quaternary (ACQ®) technology, a wood preservative that protects against rot, decay, and termite attack. These products do not contain arsenic, chromium, or other EPA-classified hazardous preservatives, but do contain copper. Additional information is available at <http://www.treatedwood.com> and from Chemical Specialties, Inc. (CSI) (30).

A possible alternative to treated exterior plywood is a product called Controlled Density Molding® (CoDeMo) made by Priema Plastics. It comes in 4 x 8 ft. sheets and is designed to replace marine and treated plywood. It is made from recycled material, and is supposed to be used as a plywood substitute. The panel is molded plastic with a foamed core to make it lighter. More information on CoDeMo is available at <http://plasticsnet.com/hettinga> or from Hettinga Equipment, Inc. (31).

Another option is a cement-board panel. There are several types of these panels, mostly imported and used in commercial construction. Plycem® is a noncombustible, structural, fiber-reinforced cement board. Additional information on Plycem® is available at: <http://www.architectualproducts.com> or from U.S. Architectural Products, Inc. (32).

Husbandry Practices to Reduce Stress

Handling Practices

The USDA organic rule states: "Animals in an organic livestock operation must be maintained under conditions, which provide for exercise, freedom of movement, and reduction of stress appropriate to the species." Understanding the behavior of pigs is an excellent means of reducing their stress during handling, moving, weaning, sorting, and when mixing strange pigs together (33). All of these various stressors have been shown to suppress the functions of the immune system and affect the pig's resistance to infectious diseases (34).

Mixing strange groups of pigs together should be avoided as much as possible. Every time the pigs get re-arranged they re-establish their hierarchy through fighting. This is one of the reasons many producers use the all-in, all-out system when working with groups of pigs. When sorting different groups of marketing hogs from several pens, it is important to not mix the different groups in a holding pen—they should be moved to the truck immediately to avoid fighting. It is especially important to never mix inappropriate social groups of pigs together—

for example, mature boars should not be mixed with other, unfamiliar boars or with any juvenile pigs.

Pigs should always be moved in small separate bunches rather than large groups. Move pigs at a slow walk. Handlers need to move slowly and deliberately. Sudden movements frighten the pigs because sudden movements are associated with predators (35). Pigs are herd animals and isolation of individuals should be avoided, except in isolation pens for disease prevention when bringing in new breeding stock. A lone pig left by itself becomes stressed (35).

A pig's previous experience with people and handling affects its reactions in the future. Pigs given gentle handling will be less stressed and have better weight gain than pigs that have had bad experiences with handling and have developed a chronic stress response (33). It has even been shown that sows that shy away from a person's hand will farrow fewer pigs than sows that readily approach a person's hand. If the sow's perception of handling is as a threat, stress increases (33).

Exerting dominance over an animal is accomplished not by beating an animal into submission, but by using the animal's natural behavior and having the handler become the "boss animal." Colorado State University's Temple Grandin explains that she achieves dominance over a group of aggressive pigs by shoving the boss pig against the fence with a board pushing against the pig's neck. The board against the neck simulates another pig pushing and biting. Pigs exert dominance over each other by this method. She suggests that more research is needed to develop simple methods of exerting dominance to help control boars and sows with a minimum of force and greater safety (33).

Grandin has found varying results in the trials that measure a pig's handling ease or difficulty in relation to amount of human contact. Some trials have shown that pigs are easier to handle following more contact with people, while other trials have shown the opposite—that the pigs were harder to handle or drive. In any case, she recommends that pigs need some degree of exposure to people. The amount of exposure can be minimal (15 seconds per day per pen of 50 or so hogs). This minimal exposure time doesn't take into account the time needed to observe each animal in order to catch any health or welfare problem early and avoid outbreaks of disease or abnormal, destructive behavior, such as tail biting. The time of exposure needs to be enough to keep the pigs from panicking when people are around and walking through the pens, but not enough to make them tame so that they want to follow instead of being driven.

The secret is to actually train the pigs to move calmly when a person walks through the pens. Pigs should never be kicked or slapped, as this causes excess stress. This exposure to people should be provided throughout the entire finishing period, not just when the hogs are close to market weight (36). Grandin found that pigs raised outdoors with a variety of playthings and daily petting are more willing to approach a strange person or walk through a narrow chute. She also observed that pigs reared outdoors are easier to load (33). Electric prods should not be necessary for moving pigs.

Grandin has designed handling facilities to reduce the stress of handling on the hogs, as well as on the people doing the sorting. Some of her suggestions for hog handling facilities include:

a) having crowd pens with an abrupt entrance or offset entrance (pigs jam in in a funnel shape);

b) not having any ramps or inclines in the crowd pens, but only after the pigs are in the single-file or double chute;
c) not curving a raceway unless the pig can see at least three body-lengths up the raceway before it actually curves;
d) designing a pig loading ramp so that the pigs are lined up single-file before they leave the sorting area; and
e) using a doublewide chute with a see-through middle partition and solid outside walls.

For more specifics on designing a reduced-stress hog handling facility, see the diagrams of Grandin's recommended designs at the website <http://grandin.com>.

On moving pigs from one pasture to another, Jim Van Der Pol comments,

> Hogs are not like cattle, and they must be moved differently. We unhook the polywire reel at the high tensile division fence, walk it back to the first tread-in post, and wind the polywire around the post. The reel can then be laid on the ground, and the rest of the fence will look real. Give them a day to move themselves. Each one must decide for herself: Never rush a pig (18).

In their pastured pig operation, Greg and Lei Gunthorp put gates around the pigs' sleeping area and shut them in at night. This saves them from the stress and time involved in chasing the pigs around the pasture (5).

Another option available for low-stress sorting of market or finishing hogs is to use the Super Sorter. The Super Sorter was designed to sort pigs in a large pen environment, such as hoop structures, without supervision. The Super Sorter uses an open design that places a scale and alleyway between the pigs and their water and feed. The pigs walk over the scale and are automatically sorted by their weight. Pigs ready for market are directed into a separate pen while the others continue to remain in their large environment. Additional information, as well as a dealers list for the Super Sorter, is available from K&L Technical Services, Ltd. (37) or from <http://www.kltechnical.com>.

Temple Grandin's list of 12 tips for sorting and loading of finishing pigs can be accessed at <http://grandin.com/references/handle.pigs.performance.html>. Here are a few of her recommendations to minimize the stress level of the pigs being moved or sorted:

1) If pigs balk or refuse to move, find out why and remove the distraction. Pigs have wide-angle vision (in excess of 300 degrees) and are easily frightened by shadows or moving distractions. They will balk at crossing a drain grate, hose, puddle, shadow or change in flooring surface or texture. Pigs are sensitive to sudden movement, such as a loose chain end or a piece of plastic flapping. Pigs have color perception and will even balk at a sudden change in color, so all handling facilities should be of uniform color. Pigs also have a tendency to move from dimly lit areas to more brightly lit areas, provided that the light is not glaring in their eyes. Pigs will refuse to enter buildings that look dark.
2) Lightweight plastic or plywood panels, canvas slappers, plastic paddles, or flags made from lightweight plastic work well to move pigs. Avoid hitting the pigs. Solid panels are useful for blocking escape attempts because they block the vision of the pig.
3) Understand the pigs' flight zone—their "personal space." When a person enters the flight zone, the animal moves away. The flight zone varies with the tameness or wildness of the pigs.

The flight zone will slowly decrease with frequent, gentle handling. This is why extremely tame animals are difficult to drive; they no longer have a flight zone. By working on the edge of the flight zone, the handler can move the pigs in the direction desired. If the handler moves too deeply into the flight zone, the pigs will either run away or turn back and run past the handler. A flag made from lightweight plastic is useful in moving groups of pigs out of pens.
4) Avoid excessive noise or shouting; calm pigs are easier to move, while excited pigs bunch together and are harder to sort or move. Pigs have sensitive hearing. Continual playing of a radio with a variety of talk and music helps reduce the reaction of pigs to sudden noises.
5) Alleyways should be 3 ft. wide to allow two pigs to walk side by side. If the alley is only 2 ft. wide, Grandin recommends moving only three pigs at a time. Pigs should not be allowed to touch or see other pigs near an entrance or exit door (16 ft. of plywood attached to pens seems to help).

Weaning Practices

Because weaning is generally a very stressful time for pigs, the producer should attempt to make as smooth a transition from pre-weaning to post-weaning as possible, especially if weaning at an early age. The sow (the piglet's protector and source of food) is taken away. The piglets are transferred to a new pen and mixed with other litters. In the new pen they need to re-establish their social hierarchy, which means they have to fight. They are also now on solid food only and usually there is not enough room for all of them to eat at the same time. "For a pig, eating is simple: if there is food, all pigs eat. Queuing up for food increases aggression" (3). Greg Gunthorp suggests that "the lowest stress weaning for pigs is to move the sows and leave the pigs" (5).

Jeffrey Rau, Animal Scientist with the Humane Society of the United States, suggests that because feeding in pigs is a social event, farmers can take advantage of the social aspects of feeding. This can be accomplished by providing at least one more feeding space than the number of pigs in the pen to encourage positive competition and synchronize all the pigs' feeding time. This is especially important immediately following weaning given that feed intake during this critical period is a major factor in how those pigs will perform for the remainder of their growth (38).

Stress-related aggression caused by lack of feeder space or re-establishment of the hierarchy can lead to increased exploratory behavior, which can lead to tail biting (see **Tail Docking** under **Physical Alterations**) or even cannibalism. If the pigs have interesting materials available for exploration, such as plenty of fresh straw, they can release this aggression on the bedding instead of each other. The AHA Standards for Pigs state:

> Where pigs develop stereotypical behavior or abnormal behaviors that injure other pigs, e.g. tail, flank, ear, or vulva biting, they must immediately be given additional stimuli to encourage foraging. When such incidents occur the caretaker must seek ways of avoiding/eliminating the problem. Avoidance/reduction of stereotypic or abnormal behavior may be aided by topping up foraging substrate daily, by scattering whole grain or feed pellets not less that twice weekly, or by otherwise sustaining foraging behavior in order to channel the animals' motivations away from abnormal behavior. Adding bulk to diets may also reduce abnormal behavior near feeding time in limit-fed animals (7).

Weaning causes an abrupt loss of passive antibodies that were provided in the sow's milk. This loss of antibodies coupled with the many other stresses of weaning can account for the baby pig's greater susceptibility to intestinal disease (34). The *Organic Livestock Handbook* states:

> Piglets should not be weaned early (not less than 6 weeks according to OCIA standards). Edema can be avoided by not feeding too much food at once to recently weaned pigs. Instead feed smaller portions that assist the animals in developing a low pH level in the stomach. This avoids undigested food in the colon, which frequently leads to E. coli development and the associated productions of toxins. If post weaning scours are a problem, Iowa organic farmer, Bill Welsh, recommends cutting protein to 20% of the recommended amount for 10 days (2).

The AWI Criteria for Pigs state:

> On each farm weaning shall take place at a piglet's weight or age that considers the health and welfare of both piglets and their mothers. This age/weight may vary, depending on the breed of the sow or gilt and level of milk production, her age and health, and the health of the individual piglets. The recommended weaning age is 6 weeks, but an earlier weaning date may be necessary, for example, if the mother is a gilt of a breed with high milk production and nursing a large litter. Minimum age of pigs at weaning shall be 5 weeks (12).

The AHA Standards for Pigs state that "Piglets must not be weaned from the sow before 3 weeks of age, unless a veterinarian confirms that the welfare or health of the sow or piglets would otherwise be adversely affected" (7).

Physical Alterations

The USDA Organic rule allows specific physical alterations when appropriately performed and within the context of an overall management system and a preventive health care program. It also mandates that physical alterations must promote the animal's welfare and be done in a manner that minimizes pain and stress. Each practice of physical alteration of the pig will need to be evaluated by the NOSB.

Jeffrey Rau comments:

> Animal welfare scientists are increasingly questioning if it is justifiable for elective surgeries to be performed on animals capable of feeling acute and chronic pain without the use of anesthetic and post-operative analgesics. As we continue to learn of the capacity of livestock and poultry animals to feel pain, frustration, and other cognitive experience, practices such as castration, tail-docking, and other mutilations such as ear notching that are considered routine in the livestock industries will be under increasing criticism. Again the key here is adapting the environment to the specific needs of the species, versus trying to change the animal to compensate for an inadequate environment (38).

Castration

The U.S. market basically requires that boars be castrated to avoid the "boar taint" in meat. The Sustainable Pork Guidelines from Texas Tech University state that "Castration is required and must be performed prior to 14 days of age" (39). The AWI Criteria for Pigs require, "If piglets are to be castrated, it must be done by the age of 2 weeks by a person proficient in the procedure" (12). The AHA Standards for Pigs state that "Castration of pigs is permitted but must be done before pigs are 7 days of age. Castration must be done by a trained and competent person using sanitized equipment" (7). Greg Gunthorp comments that in his pasture farrowing operation, "the lowest-stress castration for the pigs and owner is to get the boars when they are one day old. The sow is still slow enough that she won't tear you apart and the pigs are not easily caught after they are 24 hours old" (5).

Castration will probably be allowed in the organic production of hogs. However, the timeframe in which castration is permitted, the procedures allowed, the anesthesia or pain reduction required, and disinfectants to be used have yet to be decided.

Identification Methods

Several identification methods are used for pigs. All have advantages and disadvantages. The traditional method of ear notching (using a special cutting tool to notch the ear in a predetermined pattern to represent a specific number) is permanent and easily read without having to catch the pig. A problem is that not everyone reads the notches the same and the notching involves mutilation of the pig's ear (14).

Another procedure is ear tattooing. It is done with a set of tattoo pliers, and a set of numbers that pierce the ears. A black or green tattoo paste is then rubbed on ears to provide a long-lasting mark. Hazards include the risk of hitting a vein in the ear. The pig also needs to be caught and held in order to read the numbers. In addition, dirt and mud can make them more difficult to read, and the numbers may fade as the animal grows.

Ear tags are another option. They come in a range of colors and sizes and are fairly easy to read without catching the pig, unless they become covered with mud or dirt. Ear tags can easily be lost, however. It is recommended that tags be placed in each ear, and replaced immediately if lost (14).

> The AHA Standards for Pigs state: "Where it is necessary to mark pigs for permanent identification, ear notching, ear tagging, slap marking and tattooing are permissible. These operations must be carried out by a trained, competent caretaker, using properly maintained instruments. Ear notching must be done before the piglets are 5 days of age" (7).

A new and more expensive method uses an EZ•ID radio frequency identification implant. The device is about the size of a grain of rice and is implanted in one of the two sites recommended by the USDA Food Safety Inspection Service—subcutaneous in the right hind leg, just above the dew claw, or subcutaneous at the base of the right ear. However, the implants may move from the implanted area; movement into parts that will be used for human consumption is a problem that will need to be addressed. Each implant has a unique identification number that is read

with a handheld reader. For more information about the cost and use of this method of identification, contact EZ•ID (40).

Teeth Clipping of Baby Pigs

The AHA Standards for Pigs state that "Needle teeth of newborn pigs may be trimmed, as early as possible within the first 48 hours of life, or in the case of weak or sick piglets, within 3 days of birth. This must only be carried out by a trained and competent person. No more than the first third of the tooth should be removed" (7).

It has been a common practice to cut the sharp needle teeth or clip them with side-cutting pliers in the belief that this reduces tail biting, damage to the sow's udder during nursing, and injury to litter mates when pigs fight to establish hierarchy. However, incorrect clipping of teeth to the level of the gum can cause gum damage and tooth splintering. The sharp edges on clipped teeth can also injure the pig's tongue and provide an entry point for bacterial infections. Several studies have shown that clipping of teeth does not benefit pig survival and productivity, or prevent damage to the sow (39). Jeffrey Rau with the Humane Society of the United States explains that "when given a suitable level of environmental complexity and comfort, teeth clipping becomes unnecessary. Teeth clipping is a very primitive procedure that brings with it ample opportunity to cause suffering that can not be justified by any perceived improvement in udder and pen-mate health" (38).

Tail Docking

Tail biting usually first occurs around 4 to 22 days after weaning. A pig takes the tail of another pig crossways in its mouth and chews lightly; eventually the biting becomes more forceful and leads to bleeding, which encourages additional biting and attracts other pigs to chew on the damaged tail. If not treated and the pig penned separately to heal, the injured tail can be eaten away right to the root. The wounds can also become infected and lead to abscesses in various parts of the pig (39).

According to G. van Putten, tail biting is a matter of misdirected exploratory behavior. In unfavorable circumstances, this exploratory behavior makes the pigs want to explore the environment to discover better circumstances, and because the pigs are uncomfortable they look on other pigs as an object to explore or chew on, not as another pig (3). The *Organic Livestock Handbook* characterizes tail biting as an abnormal behavior caused by frustration.

> Tailbiting often occurs when pigs are contained in groups that are too large or have too high a density. Frustration may also be a result of irregular feeding, too short a trough length, lack of drinking water, parasites, noise levels that are too high or the presence of irritating gasses such as ammonia. If straw is available, frustration will be taken out on [it rather than on] other pigs, but obviously the best option is to avoid these stressful situations altogether (2).

The AHA Standards for Pigs currently permit tail docking to alleviate pain and suffering. However, when management methods are developed that prevent tail biting, tail docking will be prohibited (7). Rather than docking, it would be best for producers to identify and correct the circumstances leading to the tail biting behavior.

Ringing of Sows and Pigs

A pig's rooting and foraging behaviors can be hard on pastures. Placing rings in pigs' noses has been a common practice to reduce this damage. Greg Gunthorp remarks that "with enough rings sows can be kept from rooting. I haven't been able to stop little pigs from digging. The better the pasture the less the digging. Also mineral deficiencies in the pigs' diets have been shown in studies in the 1950s to cause digging" (5).

The AWI Criteria for Pigs state: "If nose-rings are used for pastured sows, the sows shall be supplied with straw or similar materials which sows can easily manipulate to build nests. Only one nose-ring may be used per sow. Nose-ringing is only permitted if by this practice, sows gain the freedom of living on pasture" (12). The AHA Standards for Pigs, however, prohibit the use of nose rings (7).

Jim Van Der Pol comments,

> We ring the sows. We use a humane-style ring in the cartilage between the nostrils—similar to a bullring. This is effective and does not create chronic soreness like the over-the-nose-lip-style. We do not ring pigs, because they are off permanent pasture by the time they reach 50 pounds. Repairing hog bathtubs and drinker holes with the skid loader is a regular spring chore on our farm. It is not a big deal (18).

Tusk Removal

There is also the task of removing the tusks from boars to prevent injury to other boars, sows, or the producers themselves. According to the AHA Standards for Pigs, "The trimming of tusks in boars may be undertaken by the attending veterinarian, or other competent person, in order to ensure the safeguarding of other animals and the caretakers from injury" (7).

Other Hog Health Issues

Vaccines

Vaccines provide two modes of protection: active immunity and passive immunity. Active immunity develops after the vaccine organism stimulates the antibodies that provide continuous protection. Active immunity works best against diseases that affect older pigs, where there is opportunity to immunize the pigs before the anticipated time of infection. Passive immunity is acquired by piglets from a vaccinated sow—the baby pigs get "second-hand" immunity through antibodies in the sow's milk. The baby pigs are thereby able to resist disease, despite the fact that their own immune systems have not yet been activated.

Actually, the first milk (colostrum) of the sow already contains very high levels of antibodies directed against the diseases found in the sow herd. For the first day or two, the baby pig's intestines are able to absorb antibodies from the colostrum and pass the antibodies intact into the pig's blood stream. The antibodies acquired from the sow's milk neutralize the disease agents present in the baby pig's intestines, so that its immune system is not strongly triggered. The baby pig doesn't begin to produce its own antibodies until about 10 days after birth. In a

cold environment, the chilling of the baby pigs at birth can reduce the amount of colostrum nursed and absorbed, which leads to a greater possibility of infection (34).

There are two methods for immunizing sows: oral feeding of live, virulent organisms or injection of killed or modified organisms. An example of feeding live organisms is the Kohler method of growing *E. coli* in milk and feeding it to the sows and gilts before farrowing. Another is the feeding of intestines from piglets that died from Transmissible Gastroenteritis (TGE) to sows in gestation. (TGE is a common viral disease that causes scours in pigs of all ages. In severe cases in young pigs, the virus in just a day or two kills nearly all the epithelial cells that line the intestine, resulting in death of the pigs from dehydration). Both of these procedures effectively provide active immunity in the gut of the sow and passive immunity in the gut of her nursing offspring. The use of modified live or killed vaccines is much less effective in stimulating this kind of immunity in sows that have not been previously exposed to the disease. The exposure of replacement gilts to the breeding herd before breeding allows the gilts to develop acquired immunity to many of the organisms found in the herd (34).

The *Organic Livestock Handbook* suggests that "keeping sows of different ages together is beneficial as this increases sow immunity. Alternatively, manure from the farrowing units can be brought to the gestation pens every week in order to expose the sows to the microflora" (2).

The administration of vaccines and other veterinary biologics are allowed under the NOP Final Rule. The regulation states that the producer of organic livestock must administer vaccines and other veterinary biologics as needed to protect the well being of the animals. All non-GMO vaccines are allowed. GMO vaccines can be petitioned, reviewed, and added to the National List upon approval by the NOSB.

Sick Animal Practices

The Organic Foods Production Act of 1990 (OFPA) states that when preventive practices and veterinary biologics are inadequate to prevent sickness, producers may administer medications included on the National List of synthetic substances allowed for use in livestock operations. Every use of synthetic medication must be incorporated into the operator's organic system plan, subject to approval by the certifying agent. It also states that animals treated with antibiotics, any synthetic substance not on the National List, or any non-synthetic substance not specified for livestock by the National List, may not be sold as organic.

Withholding medical treatment from a sick animal in an effort to preserve its organic status is not allowed. Appropriate medications must be used to restore an animal to health when methods acceptable to organic production fail. While non-organic medical remedies are discouraged and may result in loss of organic status of the treated hog, the welfare of the pig is paramount and good organic farmers don't hesitate to use non-organic remedies to avoid suffering of the pig.

The farm's organic systems plan must document the preventive measures the producer is using to deter illness, the allowed practices that will be employed if illness occurs, and the protocol for determining when the sick animal must receive a prohibited animal drug. The plan cannot allow an "acceptable" level of chronic illness, or rely on slaughter as a disease management tool.

The plan must reflect a proactive approach to health management using allowed practices and materials.

Iron Supplement for Baby Pigs

Baby pigs need iron to grow, but do not receive adequate levels in the sow's milk. Because injectable iron is not allowed under the Final Rule, organic producers will need to choose an alternative method of providing iron. One way is to provide the baby pigs a source of parasite-free soil to root in or eat. Under pasture farrowing conditions in the summer, this is not a problem. However, farrowing in a Swedish deep-bed system or using other bedded farrowing alternatives during the winter months can make this more complicated. An option is to place a pan with soil in a common baby-pig-only area (this will necessitate collecting and storing soil before the ground freezes). Another option is to plow some shallow furrows of sod and soil in a clean pasture in the fall. Then the sod chunks can be broken into manageable sizes and stored sod-side-down in a pile near the farrowing facilities. These sod chunks can be given to the baby pigs just like the pan of soil.

A Selection of Relevant Research, Writings and Resources

Group Housed Dry Sows on Deep Straw Bedding: Researchers with the Swedish Animal Health Service studied the occurrence of *Oesophagostomum* spp. roundworms in group-housed dry sows on deep straw bedding. They determined that the prevalence of egg-positive samples, as well as the intensity of infections, were significantly higher with the dry sows in the deep-straw bedded systems than with sows kept in pens with a concrete lying area and a dung area with or without slatted floor.

They reasoned that the environment in deep-straw bedding provided a greater possibility of parasite transmission among sows because the deep bedding is mixed with the feces and the microenvironment in the bedding is conducive. They suggested that the sows became infected when they ate the bedding, especially during limited feeding in the gestation period. They also discovered that pre-farrowing anthelmintic (worming) treatments had no effect on the fecal egg output in sows kept on deep-straw bedding.

The increased occurrence of infection was not expected to result in any clinical symptoms in the sows, but might reduce reproductive performance by causing more still births. The researchers suggested that if group housing of sows on deep-straw bedding leads to increased occurrence of *Oesophagostomum* spp., other preventive measures should be evaluated, such as pre-mating treatments of effective anthelmintics and turning the sow onto fresh straw in cleaned pens.

Holmgren, N. and O. Nilsson. No date. Oesophagostomum spp in group housed dry sows on deep straw bedding. The Swedish Animal Health Service, 532 89 Skara, and 291 25 Kristianstad, Sweden. 3 p. <http://www.svdhv.org/ForsknUtv/artiklar/173-40es.html>.

Swedish Deep-Bedded Feeder Pig Production with Farrowing Cubicles: Iowa State researchers studied nine farrowings (2.5 years) in a Swedish deep-bedded feeder pig production system. The farrowing, group lactation, and nursery facilities were in a remodeled 1950s-style hog house. Farrowing cubicles with rollers and oat straw were used. The gestation sows and

replacement gilts were kept in a hoop structure with cornstalk bedding and individual lockable feeding stalls. The replacement gilts were bred and kept separate until farrowing when they were mixed with the older sows. There was about 27 sq. ft. of bedded area per sow.

They reported that the conception rates and litter size were excellent. The sows selected their bedded farrowing cubicles and farrowed successfully; however, the pig mortality was high at 28 percent—mostly by crushing—in the first 3 days. At 2 weeks, the cubicles were removed and the group lactation worked well, with an average pig weaned at 23 pounds at 36 days of age. At weaning, the sows were removed and the pigs stayed in the room for another 24 days. At the end of the 60 day period, the 55-pound pigs had averaged about 1.22 lbs. daily gain. The overall pig health was excellent with no major diseases confirmed.

Honeyman, Mark and Dennis Kent. 1999. Performance of a Swedish deep-bedded feeder pig production system in Iowa. Iowa State University 1999 Swine Reports. 4 p. <http://www.extension.iastate.edu/ipic/reports/99swinereports/asl-1683.pdf>.

Swedish Deep-Bedded Feeder Pig Production with Farrowing Crates: Iowa State researchers expanded their study of the Swedish deep-bedded, group-housing system known as Vastgomodel. Ljungstrom and Thorstensson are two different versions of the Vastgomodel system. The Thorstensson model uses farrowing cubicles that are removed after 7 to 10 days, while the Ljungstrom model uses conventional farrowing crates or pens for the first 10 to 14 days before the sows and pigs are moved to group nursing rooms. The researchers wanted to determine if preweaning mortality could be reduced from the high 28 percent mortality previously found in the Thorstensson model.

They found that the prewean mortality could be reduced to 2 percent by using conventional farrowing crates for the first 2 weeks before moving to the group nursing rooms. It was determined that during the first week of group lactation (14 to 21 days of age), the rate of gain for the pigs was 24 percent less than for conventional pigs. However, during the next week, the group-lactation pigs grew 65 percent faster than the conventionally weaned pigs, while the overall growth rate of the group lactation pigs was 7 percent faster than that of the conventionally weaned pigs.

Larson, M. E. and M. S. Honeyman. 2000. Performance of pigs in a Swedish bedded group lactation and nursery system. Iowa State University 2000 Swine Reports. 3 p. <http://www.extension.iastate.edu/ipic/reports/00swinereports/asl-677.pdf>.

Comparing Performance of Finishing Pigs in Hoops and Confinement: In a two-year Iowa State trial that combined both winter and summer production of finishing pigs in hooped and confinement facilities, the pigs in the hoops ate more feed, grew faster, and required more feed per unit of live-weight gain than confinement pigs. Between the two systems, the mortality rate was equal, but the percentage of culls was higher in the hoops. The hoop pigs were fatter in the summer and were less efficient in the winter. The hoop pigs had greater incidence of roundworm infestation, despite a thorough deworming regimen. Bedding use was about 204 lbs. in the summer and 236 lbs. in the winter. The stocking density in the hoops was 12 sq. ft. per pig and 8 sq. ft. in confinement. Each hoop was designated a pen. The hoop structures were 30 x 60 ft. with 150 pigs per hoop.

Honeyman, M. S., et al. 2000. Two year summary of the performance of finishing pigs in hoop structures and confinement during winter and summer. Iowa State University 2000 Swine Reports. 6 p. <http://www.extension.iastate.edu/ipic/reports/00swinereports/asl-681.pdf>.

Comparing Welfare of Finishing Pigs in Hoops and Confinement: In a study by researchers at Iowa State comparing pig welfare in hoop structures and in nonbedded confinement systems (NBCS) during both summer and winter conditions, pigs in the hoops had greater welfare than pigs raised in the NBCS. The NBCS system did provide better protection from environmental conditions and from predators, but showed more signs of stereotypic behavior—bar biting and belly nosing—and lameness in the pigs. The NBCS pigs performed more aberrant behaviors—manipulating others, ear biting, tail biting, etc.—and less play behavior, had greater plasma cortisol in response to handling (but fewer vocalizations), and a greater incidence of injuries than pigs raised in hoop structures.

Lay Jr., Donald C., Mark F. Haussmann, and Mike J. Daniels. 2000. Hoop housing for feeder pigs offers a welfare-friendly environment compared to a nonbedded confinement system. Journal of Applied Animal Welfare Science. Volume 3, Number 1. Pages 33–48.

Three Hoop Structure Projects in Minnesota: The Energy and Sustainable Agriculture Program (ESAP) at the Minnesota Department of Agriculture has provided grants for farmers, researchers and educators to experiment with new and innovative farming practices and systems. Three of these projects involved various aspects of hoop structures. The first project was "Deep Straw Bedded Swine Finishing System Utilizing Hoop Buildings," involving Mark and Nancy Mouton. They have been monitoring economics, labor, and environmental performance. The next project was "Hoop Houses and Pastures for Mainstream Hog Producers," involving Josh and Cindy Van Der Pol. Labor requirements and production figures for farrowing in hoop houses and on pasture in huts were compared to figures from conventional confinement production. The last project was "Low Cost Sow Gestation in Hoop Structures," with Steve Stassen. It demonstrated a deep-bedded hoop building for better housing and control of his gestation sows.

Minnesota Department of Agriculture. 1999. Deep straw bedded swine finishing system utilizing hoop building; Hoop houses and pastures for mainstream hog producers; and Low cost sow gestation in hoop structures. The Greenbook'99. Energy and Sustainable Agriculture Program. 8 p. <http://www.mda.state.mn.us/esap/Greenbook.html>.

Small Scale Hoop Structures: Researchers at Iowa State University erected a 14 x 30 ft. hoop structure with large square bales of straw used for the foundation. The interior space was 348 sq. ft. The researchers placed twenty-one 138-lb. pigs in the hoop and fed them to market weight.

The small-scale hoop worked well for the group of pigs, which were in the hoop for 64 days and were marketed at a 259-lb. average. Their average daily gain and feed conversion were consistent with averages for other housing facilities. The researchers noted that at market weight the hoop seemed crowded. Therefore, they recommend more than the standard 12 sq. ft. per pig for pigs in hoops—about 14 to 16 sq. ft. would be better. Also, because of the smaller size, the waterer and feeder took up a larger percentage of the space, and the dunging and sleeping areas appeared to be congested.

Based on this study, the small-scale hoop structure appears to be a low-cost option that is easy to build. The straw bales lasted about 6 months, but would have lasted longer in drier conditions. The hoop structure can be disassembled and relocated to a new foundation.

Honeyman, M. S. and L. Rossiter. 1999. Small scale hoop structures for market swine. Iowa State University 1999 Swine Reports. ASL-R1684. 3 p. <http://www.extension.iastate.edu/ipic/reports/99swinereports/asl-1684.pdf>.

Organic Pork Budget: Iowa State University has prepared O*rganic Pork Production: A Two-litter Pasture Farrow-to-Finish Budget*. The budget discusses organic pork production and the profit potential. It was written before the USDA regulations were released and some changes or corrections may be needed. They calculated the breakeven cost of organic production to be about $55/cwt live.

Becker, Jude M., M. S. Honeyman and J. B. Kliebenstein. 1999. Organic pork production: A two litter pasture farrow-to-finish budget. Iowa State University. 8 p. <http://www.extension.iastate.edu/ipic/reports/99swinereports/asl-1679.pdf>.

Alternative Swine Production Systems Listserv: In May, 2001, the Alternative Swine Production Systems Listserv was started. The mailing list consists of producers, extension, faculty, and others interested in alternative hog production systems, such as hoops, pasture, and Swedish deep-bedded system. It will provide an opportunity to discuss the use of alternative systems, make announcements, and learn about various research activities. To subscribe to altswine-l, send mail to LISTSERV@TC.UMN.EDU, with the command (paste it into the text of the email) subscribe ALTSWINE-L Your Name (name attached to your email address).

Minnesota Research in Progress: The West Central Research and Outreach Center in Moorhead, Minnesota is establishing alternative swine housing research facilities. These will include hooped shelters for gestation sows, handling/sorting facilities, a Swedish deep-bedded system, and an outdoor pasture sow operation.

Their experiment-in-progress is titled "The exploratory behavior and fearfulness of growing pigs in deep-litter and confinement housing systems." The aims of this experiment are:

> 1) To study the exploratory behavior and fearfulness of swine housed in confinement pens and in a deep-litter, group housing system (an enriched environment);
> 2) To study the behavior of pigs in a handling and weighing facility and to ultimately develop a handling facility that allows efficient weighing and sorting of market pigs;
> 3) To collect data to be used to develop an enterprise budget for deep-litter, group housing systems for growing pigs (e.g., labor inputs, straw usage, vet/medical, deaths, repairs, etc.); and
> 4) To collect growth performance data (pen feed intakes, individual live weights at 9 and 23 weeks, and carcass data) from pigs housed in a deep-litter group housing and confinement system.

The principal investigator is Rebecca Morrison at West Central Research and Outreach Center, State Highway 329, P.O. Box 471, Morris, MN 56267, Tel: 320-589-1711.

Morrison, Rebecca. 2001. Research and facilities at WCROC. <morrisrs@mrs.umn.edu>. Wed., 16 May 2001 to altswine-l@tc.umn.edu. 2 p.

Designing Feeding Programs for Organic Pork Production: A University of Minnesota publication addressing the nutrition of swine raised in organic systems is expected to be completed by October, 2001. Written by swine researchers and extension personnel, it will include sections on allowable feeds and substances including alternative feedstuffs; documentation and records; management suggestions addressing challenges in organic production; forages in swine diets; and a list of suggested diets using a variety of feedstuffs, all in the context of organic standards. For more information or to request a copy, contact:

Bob Koehler, Extension Educator
Livestock Systems/Swine
Southwest Research and Outreach Center
P.O. Box 428
Lamberton, MN 56152
(507) 752-7372; Fax: (507) 752-7374
E-mail: koehl009@umn.edu

Innovations to the Farrowing Crate: The Danish manufacturer Ikadan has patented a new farrowing stall with a diagonal partition wall between pens, permitting more space for the sow to move around. The piglets are protected against crushing by simple but effective tipping balls. They are currently making design changes to their patented system to further reduce crushing problems. For additional information on Ikadan's VIP farrowing pen, contact:

Ikadan System
P.O. Box 1488
Clinton, NC 28329
(910) 590-3550; Fax: (910) 3540
E-mail: ikadan@ikadansystem.com
http://www.ikadansystem.com/vip.html

Tips for Raising Pork on Pasture: Greg and Lei Gunthorp have been quoted and referenced many times throughout this publication. An article that summarizes the Gunthorp pastured pork operation was published in the July, 2001 issue of *American Small Farm* magazine. For additional information about this magazine contact:

American Small Farm
Attn: Circulation
267 Broad Street
Westerville, OH 43081
(614) 895-3755; Fax: (614) 895-3757
E-mail: info@amsllfarm.com
http://www.smallfarm.com
Published monthly. Subscription rate is $18.00 per year.

Some Thoughts on Marketing

Despite the fact that "organic" is a process claim, not a product or health claim, the growing demand for organic foods is driven primarily by consumers' belief in the higher quality and safety of these foods, as well as their awareness of the positive environmental, animal welfare, and ethical impacts of organic agriculture practices. This growth in demand is expected to continue in the foreseeable future (41).

Organic pork, like all other organic products, has to perform commercially alongside conventional products. Organic pork should not be considered a threat to conventional production, but as a complementary alternative for those who demand choice. Organic pork can be differentiated without damaging conventional pork's credibility (42).

A study from the University of Minnesota Swine Center found that modest producer premiums are likely to continue over the long term for organic and natural pork production. The reason: "Increases in supplies (of organic pork) are unlikely to keep pace with expected increases in demand that cause higher prices," according to economist W. Parker Wheatley. He comments that "the demand is driven by the perceived safety of organic and natural products." Demand is also driven by the perception that organic products improve environmental quality. "Consumers view the premiums paid to organic producers as implicit rewards for reducing the pollution associated with production. An additional source of increased demand is the consumer perception that natural and organic production provides for improved animal welfare" (43).

While the study did not look into actual premiums received by producers, Wheatley says that "In the fall of 2000, one processor/marketing firm paid $6 per hundred over the mean market price for Iowa/Southern Minnesota with a minimum price of $40 per hundred. The same firm will pay $65 per hundred live weight for organic pork. Another national cooperative was paying an average of about $50 per hundred live weight for organic pork." He also states: "These premiums don't seem substantial given that market prices per hundred pounds live weight ranged between $40 and $50 in 2000. However, the premiums existed even when prices were lower in 1998 and 1999, and provided some stability to these producers' income."

For more information or a copy of this study, which was funded by the Minnesota Pork Producers' Association, contact Wheatley at (612) 669–0331, <whea0024@umn.edu>.

These current premiums are good news for organic hog producers, who know that they need to receive fair prices for their products. Nonetheless, most of the premium pork markets are niches still in their infancy. They have the potential to grow as more and more consumers make their choice to buy organic pork products. However, organic farmers will need to take control of their markets in order to generate enough income to support their farms, and to entice more conventional producers to convert to organic production practices, thus increasing the organic market share.

In Closing

With careful planning, a good conventional producer is likely to succeed in an organic system. The organic conversion period can be a conversion period of the mind. Conventional producers have to radically change their farm management strategies. Organic hog production can be more challenging than organic production of ruminants. Some of the additional challenges involve access to organic protein and other feed additives; climatic challenges from both heat and cold to vulnerable pigs, especially baby pigs; parasite and disease control; marketing; etc. More research and study are needed to help identify which systems and practices will allow the organic hog producer to raise organic pork both successfully and profitably. However, certification agencies have noted that once a person has tried organic production they find it hard to go back to conventional farming (42).

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<http://www.extension.umn.edu/distribution/livestocksystems/DI7641.html>.
Can be ordered for $5 plus $2 shipping from:
University of Minnesota Extension Service
Distribution Center
405 Coffey Hall
1420 Eckles Avenue
St. Paul, MN 55108–6068
(800) 876-8636, Fax: (612) 625-6281
E-mail: order@extension.umn.edu

22) *Graze*
P.O. Box 48
Belleville, WI 53508
(608) 455-3311, Fax: (608) 455-2402
E-mail: jrmcnair@chorus.net
Published 10 times per year. Subscription rate is $30.00 per year or $54 for 2 years.

23) *Swine System Options for Iowa: Swedish deep-bedded group nursing systems for feeder pig production*
Iowa State University
Extension Distribution Center
119 Printing and Publications Bldg.
Ames, Iowa 50011-3171
(515) 294-5247; Fax (515) 294-2945
E-mail: pubdist@iastate.edu
Publication SA 12 for $0.75 plus $1.00 shipping

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Midwest Plan Service
122 Davidson Hall
Iowa State University
Ames, IA 50011-3080
(800) 562-3618
http://www.mwpshq.org
Cost is $4 each plus $1 shipping.

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includes shipping and handling. Contact BIRC, PO Box 7414, Berkeley, CA 94707, Tel: (510) 524–2567, Fax: (510) 524–1758, E-mail: <birc@igc.org>, < http://www.birc.org>.

28) NCAT Center for Resourceful Building Technology
P.O. Box 100
Missoula, MT 59806
(406) 549–7678, Fax: (406) 549–4100
E-mail: crbt@ncat.org
http://www.crbt.org

29) LIVOS Phytochemistry of America, Inc.
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http://www.livos.com

30) Chemical Specialties Inc. (CSI)
One Woodlawn Green, Suite 350
200 East Woodlawn Road
Charlotte, NC 28217
(800) 421–8661, Fax: (704) 527–8232
http://www.treatedwood.com

31) Hettinga Equipment Inc.
2123 NW 111th Street
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(800) 776–7628, (515) 270–6900, Fax: (515) 270–1333
http://www.plasticsnet.com/hettinga

32) Architectural Products Inc.
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(800) 243–6677, (401) 725–8550, Fax: (401) 725–8540
E-mail: info@architecturalproducts.com
http://www.architecturalproducts.com

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24 Springhaven Circle
Airdrie, Alberta, Canada T4A 1A7
(877) 544-5658 toll free or (403) 948-0341
Fax: (403) 912-0801
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Toll free: (877) 330-EZID (3943)
(970) 330-7701; Fax: (970) 330-7707
E-mail: EZIDelsie@aol.com

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Further ATTRA Resources Available:

The following ATTRA publications relate to the subjects in this document:

Sustainable Hog Production
Hooped Shelters for Hogs
Alternative Meat Marketing
Alternative Marketing of Pork
Manures for Organic Crop Production
Farm-Scale Composting Resource List
Sustainable Soil Management
Assessing the Pasture Soil Resource
Rotational Grazing
Sustainable Pasture Management

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July 2001

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