



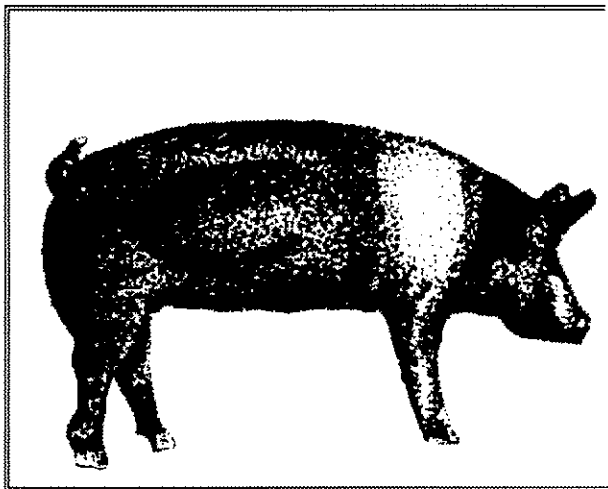
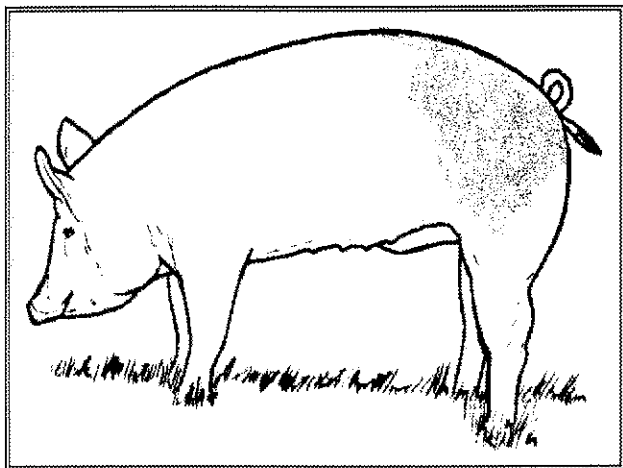
SUSTAINABLE HOG PRODUCTION OVERVIEW

LIVESTOCK PRODUCTION GUIDE

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Abstract: This publication discusses various aspects of sustainable hog production, including breed selection, feed alternatives, odor and dust problems, waste and crop nutrient management, health, humane concerns, vertical integration, and identifying an alternative marketing niche. Information on hooped shelters for finishing hogs and gestating sows; pasture production and farrowing; Swedish deep-bedded group nursing system; and alternative marketing of pork is available in other ATTRA materials. Sources of additional information are also provided.



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Introduction

ATTRA's mandate is to promote the adoption and practice of environmentally sound, sustainable agriculture by providing reliable and practical technical information about agricultural production and marketing to American farmers. This means that sustainable agriculture is a mixture of both mainstream and organic practices with incorporation of new and developing farm technologies. Sustainable agriculture's aim is to meet the food and fiber needs of society, while strengthening rural communities and conserving precious natural resources.

Sustainable hog production techniques can enhance the producer's profits, while improving local environmental impacts. Traditional hog production has been integrated into a row crop and livestock operation. Livestock manure is utilized in the grain-legume rotation. Hogs have been a dependable source of cash income for family farms.

Sustainable hog producers have particularly focused on some of the following goals:

- Reducing capital investment in specialized buildings and equipment;
- Reducing feed cost by using forages and other alternative feedstocks;
- Gaining more control over marketing, especially pricing, of hogs produced;
- Establishing new farm marketing methods;
- Exploring value-added and farm-processed products;
- Reducing the risk of water pollution from hog manure;
- Being a good neighbor by reducing offensive odors;
- Working to integrate the hog operation fully with other farm enterprises.

Mark Honeyman, associate professor of animal science and coordinator of the Research and Demonstration Farms at Iowa State University, explains:

Ecologically-sound swine production emphasizes intensive management of the swine and its entire environment. This means considering all aspects of the animal: its behavior, physiology, nutrition, breeding, health, and reproduction. It also means designing the system with the whole farm in mind, including its soil, topography, crops, other livestock, and the operator. Finally, along with the swine, the farm and the producer, the consumer of pork also must be considered when the system is assembled (1).

It is very important to plan for start-up and expansion. If a very thorough plan is not developed for a sustainable hog operation, many future options may be more expensive to correct or add at a latter date. First, a producer needs to consider what type of operation is most suitable for his circumstances. For instance, he should determine whether to run a farrow-to-finish production system, to farrow and sell the feeder pigs, or to buy feeder pigs and finish them. Another consideration is whether existing buildings can be remodeled to make them suitable for sustainable production, or if new buildings should be constructed.

Planning requires giving serious thought to details of a hog operation.

- What type of breeding stock is contemplated and availability at the price and quantity needed;
- Location of market for the type of pigs that will be produced;
- Options for direct marketing of value-added or farm-processed products;
- Opportunities for expansion;
- Whether a profitable projected financial analysis can be prepared;
- Whether pastures are available, or would other sources of forage be more suitable;
- Whether other alternative feeds can fit into the feeding program;
- What plans can be contemplated for recycling the wastes back onto crop land; and
- Whether there are other areas of concern that need consideration?

A major consideration in the planning of a sustainable hog operation is that a low-investment swine facility is more versatile. This is one of the many reasons hooped shelters for finishing hogs and gestating sows are becoming very popular.

A low-cost hog operation can be more easily adjusted to changing marketing conditions, labor requirements, and other variables than can confinement buildings with a large capital investment.

The competitiveness of a sustainable operation with more conventional or confinement systems can be determined by four factors. These are feed costs; non-feed costs (fixed and variable costs); biological efficiency (pigs weaned per sow per year); and facility efficiency (number of pigs weaned per farrowing crate/pen/hut per year). All of these factors need to be considered to keep the costs as low as possible per pig. ISU records also show that for the past decade there has been a \$24 difference in the cost of finishing a pig when comparing the one-third most profitable producers against the least profitable one-third (2).

Several alternative methods for sustainable hog production have been researched.

- Using hooped shelters for finishing pigs or gestation sows;
- Swedish deep-bedded, group nursing systems for feeder pig production;
- Pasture farrowing systems,
- or a combination of these alternative methods.

ATTRA can provide specific information on using hooped shelters, the Swedish system, or pasture farrowing.

Marketing

Vertical Integration

The pork industry is currently being consolidated in the direction of what many people consider

non-sustainable production practices. The number of hog producers is rapidly decreasing every year. Between 1971 and 1992, the number of hog farms decreased from 869,000 to 256,390 (3), and between 1950 and 1992, the percent of U.S. farm with hogs decreased from 56% to less than 10% (4). While the number of hog producers is decreasing, the large operations are expanding or increasing in actual numbers. Between 1988 and 1997, the percentage of producers marketing less than 1000 head a year decreased from 32% to 5%, the number of producers marketing greater than 50,000 head a year increased from 7% to 36% (4).

A few large-scale producer/packer/processors linked from farrowing to packing and finally to the retail counter (vertical integration) may soon put pork production in the same predicament as poultry production is in today. Packers direct-contract more hogs today than in the last decade. Packers say they are increasing contracting and integration because of their dissatisfaction with the availability and quality of hog supplies. Packers also state that they are responding to niche-market pressure requiring a specific genetic type and weight of hog carcass (4).

Access to plentiful and cheap grain, as well as cheap transportation costs, makes hog production attractive to large corporate confinement operations. Corporate hog operations are growing at an incredible rate, mainly at the expense of the independent hog farmer. North Carolina is an example of how pork production in a state can change when corporate factory farming comes into it. Between 1987 and 1992, the number of hogs in North Carolina more than doubled and between 1988 and 1994 the number of pork producers decreased by 48%. The decrease occurred mainly among independent hog operations or operations not contracting with corporation and private company giants. In the five-year period between 1987 and 1992, the number of hogs jumped from 2.5 to 5.4 million-head (5).

In the past when low hog prices or high costs put independent hog farmers in a squeeze, the independent farmers reduced the breeding stock

in the operation. But corporate factory farms don't reduce because they have too much capital invested. Factory farms have their own slaughtering and marketing networks. They continue expanding independent of costs. Rod Smith in an article in *Feedstuffs* states "There aren't enough of the diverse, inner-and-outer traditional sized producers left to go out of business at that end to offset the expansion of the large producers at the other end (6)." The large producers might slow down some of their expansion plans briefly, but the factory farms will leave the reduction adjustments of hog numbers up to the independent hog farmers. But that strategy may have caused pork producers to expand production an estimated 9% in 1998 and caused the lowest prices and largest losses in history (6).

No matter who is involved in factory farms and/or vertical integration, the strategy remains the same. The beneficiaries are the corporate or private company giants, and those that bear the costs of moving up to integration are the contract growers who have no control over price, production, or profit (7). Also, rural communities (which float bonds to entice the corporations), the environment, the taxpayer, neighbors, and others usually receive little benefits from these large operations.

In an article in *Rural Papers* Neil Hamilton, professor of agricultural law at Drake University, states "Some contracts may be more a form of risk shifting than risk sharing (8)." In the same article, John Carter, a Topeka attorney, analyzed a sample contract offered to some southwest Kansas farmers by Seaboard Inc. Carter commented that "Seaboard covers itself well, while the farmer/grower is put in a very tenuous and disadvantageous position." The contract they analyzed put nearly all the liability and risk of loss on the farmer. The farmer is liable for any lawsuits that stem from leakage or improper application of wastes, and the farmer has to pay most of the taxes. The contract even states that the producer waives any right to sue Seaboard and bears the risk of damages resulting from advice given by a Seaboard representative. The article concludes by stating, "In an industry claiming they pose

little to no risk to the environment, they [Seaboard] clearly lay the liability for any nuisance, pollution, or negligence of its employees on the producer (8)." *Time* magazine's November 30, 1998, article entitled "The Empire of the Pigs—A Little-Known Company is a Master at Milking Governments for Welfare" provides additional information on Seaboard Inc.

Vertical integrators do not need independent producers; they want producers tied to them with contracts. They have their own operations in every phase of pork production. From farrowing-to-finishing factory farm gate to the packinghouse to the fresh and frozen meat case, vertical integrators need no help from anyone.

But rural communities do need help. John Ikerd, agricultural economist and coordinator at the University of Missouri Sustainable Agriculture Systems Program, has found that for every \$5 million in new investments that contract hog units make, they will create about 40–45 new jobs—at a cost of two to three times that many established independent farmers (9). Vertically integrated hog operations require fewer farmers to manage the animals and fewer support people in the community to help these farmers. This adds up to less business done in the rural community. The substitution of capital and mass-production technologies for labor and management is the primary advantage that these large operations have over smaller independent operations.

University of Missouri rural sociologist William Heffernan has found that the profits from an independent producer have a multiplier effect of three to four in a local community, but profits from a corporate or private company-owned farm leave the local community almost immediately (10). Another study in Minnesota found that for livestock intensive operations, the percentage spent locally (within 20 miles of the farm) declined dramatically with the increase of the size of the operation. So rural communities and even states need to consider what is more important to them—having a large number of hogs produced or having a large number of hog producers (11).

Various economic analyses conducted in Kansas and Illinois have found that large factory farms lose their economies of scale beyond a certain size, and that the size of the operation is not as important in making a profit as how well the hog operation is managed.

Can small independent operators compete when the market favors the large operations that can supply larger volumes of hogs? According to *Hogs Today* magazine, during the fall of 1993 corporate owned hogs were receiving \$51 per hundredweight at North Carolina packing plants, while local buying stations were paying \$39 to independent producers (5). Congress is being pressured to investigate these price differentials.

But until changes can be made in a market favoring large producers that much, how can the independent producer continue to compete? Family farms should be able to compete economically when they are dispersed throughout the nation (rather than factory farms and large-scale confinement operations) using sustainable practices, if the family farmer has the support of the consumer and community.

Alternative Niche Marketing

Alternative niche marketing practices can be connected with various aspects of these alternative production systems. Consumers are looking for safe, healthy food products raised in various systems, such as humane, organic, earth-friendly, free-range, antibiotic-free, etc. Mark Honeyman explained "We're going to see many more labeled meats. There may even be contracts to buy 'family farm' hogs, or the like (12)."

Although many pork producers have not developed their marketing skills, there is a real opportunity for value-added or premium products raised in sustainable systems (12).

This opportunity has been verified by recently completed research funded by the Leopold Center at Ames, Iowa. The research suggests that a producer can add value to pork production by capitalizing on marketing meat produced in ways

that benefit the environment. Iowa State University economics professor James Kliebenstein and graduate student Sean Hurley suggest that "consumers may be willing to pay nearly \$1 more for a package of pork chops produced under a system that improves air, groundwater and surface water quality (13)."

In four diverse market areas, 62% of the randomly selected people stated that they would pay a premium for pork raised in a system that offered maximum environmental benefits. These systems were described as operations with an 80 to 90% reduction in odor, and 40 to 50% reduction in potential groundwater and surface water contamination. The researchers surmise that "as the [pork] industry develops methods that help sustain or improve the environment, there is a segment of society that will support a market for such products." Further information about this research is available by contacting Kliebenstein at jklieben@iastate.edu, phone (515) 294-7111, or Hurley at shurley@iastate.edu, phone (515) 294-8891 (13).

An example of a niche marketing opportunity is Patchwork Family Farms that are composed of 12 independent family hog farmers. They market pork raised in an old-fashioned way using sustainable and humane growing standards that prohibit growth or synthetic growth promoters, and provide sources of water and feed that must be antibiotic-free. They also stress that animals must receive adequate amounts of sunshine, fresh air and quality feed necessary to maintain good health (14).

ATTRA can provide more specific information on alternative niche marketing of labeled pork products. Contact ATTRA again to request this information.

Related ATTRA Publications

Hooped Shelters for Hogs
Farm-Scale Composting Resource List
Sustainable Soil Management
Overview: Adding Value to Farm Products
Direct Marketing
Organic Certification

Other Related ATTRA Materials

Pasture Farrowing and Production
Swedish Deep-Bedded Group Nursing System
Alternative Marketing of Pork

Production

Breed Selection

Selection of breeding stock to be used in a sustainable hog operation is very important. All breeds of pigs have certain individual traits that can be advantageous to sustainable hog production. So before purchasing breeding stock, it is advisable to find a seedstock producer raising pigs in conditions similar to the conditions that the sows will encounter, whether pasture or confinement. Research at Texas A&M indicated that selection of sows for range-ability (ability to nest and farrow on her own) is a highly heritable trait, and could be genetically selected for in pasture operations (15).

Whether purebred or crossbred, gilts or sows of the breed or breeds chosen should be fertile, be good milk producers, have strong maternal instincts, and be easy to handle. Boars should be selected for growth rate, feed efficiency, leanness, and a strong sex drive.

Another important consideration is availability of stock. How many gilts or sows and boars are needed for the operation? Are the quality and quantity that are available locally or regionally suitable for the producer's needs, or will the producer want to raise his own replacement breeding stock?

The most common breeds of pigs in the United States are Yorkshire, Landrace, Hampshire, Duroc, Chester White and Spotted Poland China. All of these breeds have characteristics that have kept them in current use in many different hog operations. Besides the more common breeds of hogs used today, there are many breeds of swine that are now considered minor breeds. These include the Berkshire, Tamworth, Poland China, Large Black, and Gloucester Old Spot Pig. These minor breeds of hogs have lost favor with hog

producers for a number of reasons, chiefly the increase of confinement production. For those interested in additional information or breeding stock availability of these minor breeds, contact the American Livestock Breeds Conservancy (16).

Purebred breeding stock for the more common breeds of pigs should be available from seedstock swine breeders. Other sources of seedstock are national or international swine breeding companies. To find local or regional seedstock or breeding companies, the producer should check with the county Extension office, hog magazine ads, newspaper want ads, or neighborhood hog producers.

In a low investment swine demonstration project using Yorkshire x Landrace sows, the Kerr Foundation of Poteau, Oklahoma, recommended that a producer purchase only specific pathogen-free (SPF) hogs. SPF classification guarantees that the hogs are free of turbinate atrophy, pneumonic lesions, swine dysentery, pseudorabies, brucellosis, lice, and mange. SPF breeding stock are more expensive, but the Kerr Foundation project had a total lack of health problems with its swine as a result of this extra investment. The National SPF Swine Accrediting Agency (17) provides information on availability of SPF breeds of hogs. The people involved in the Kerr Foundation also recommended a strict culling process of any sow not weaning at least 7 healthy pigs. A "survival of the fittest" policy is recommended for the baby pigs, because pigs that have to be helped to nurse are runty and hard to market (15).

Feed Alternatives

Conventional swine rations consist primarily of corn and soybean meal. Honeyman contends that by changing the diet of Corn Belt swine, the face of Corn Belt agriculture can be changed, if economics and policies permit. As versatile omnivores, pigs can utilize a wide range of feeds. Alfalfa could be included in a corn-soybean rotation. For example, in 1978, forages made up about 15% of all United States swine feeds. If forages could be increased to 25% of the total swine feed, the amount of grain could be reduced

by about 15%. This change could have beneficial effects on the environment (1).

A three-year study by Auburn University's swine nutritionist Terry Prince proved that as much as two-thirds of a sow's feed needs can be satisfied by a well-managed pasture program, providing mineral and vitamin needs are supplemented. Prince put the cost of maintaining the pastures in Alabama at \$217 per acre. With 12 sows to the acre, that is \$18 per sow per year (sows were not farrowed on pasture, but moved to a confinement farrowing house for 30 days before returning to pasture). He believes pasturing will save 2 pounds of corn and .35 pounds of soybean meal a day. His feed savings came to \$28.33/sow/year, when the sows were grazed 275 days a year, and the value of corn was \$2 a bushel and soybean meal was \$180 a ton. Producers need to calculate the feed cost saving with their corn and soybean meal costs, the number of days for sows on pasture, and their cost of maintaining pastures (18).

Colin Wilson, who farms with his father and brother at Paullina, Iowa, has worked the bugs out of their pasture-farrowing system by trial and error the past 20 years. Wilson stresses that timeliness is critical, and that many jobs require two or even three people. They use a three-year rotation in three adjacent 18-acre fields. The rotation begins with corn, followed the next spring with a drilled mix of 3.5 bushel of oats, 10 lbs. of alfalfa and 3 pounds of orchardgrass. Oats are harvested, leaving a thick pasture cover for the hogs the following year. Colin explained that it took a long time to develop a successful pasture mix. He found that pastures with too little alfalfa were not as palatable to hogs, and that pastures with too much alfalfa did not produce a good orchardgrass stand and tended to be muddy in wet years.

Fencing the pasture is also important for the Wilsons' operation. As soon as possible in the spring, they string a two-wire (14-gauge) electric fence around the perimeter of the pasture; one wire is 4-8 inches high, and the other wire is 18-24 inches high. Each wire has its own charger so there is always a hot wire if one charger malfunctions. This pasture is then divided into

150 by 300 foot pens, also using double wires. Wilson says it is not a good idea to charge the gates. If the gate is charged, the hogs learn not to pass that point, and then the producer will not be able to drive the hogs through the gate when open (19).

In addition to legume and grass pastures, non-legume brassicas such as turnips, rape, kale, fodder beets and mangels are high in protein and highly digestible, and make an excellent pig pasture.

Another option is the practice of having pigs self-harvest the grain crop, otherwise known as "hogging off" the crop. Some of the advantages of "hogging off" are that harvesting costs are eliminated; crop residues and manure are left on the land; and parasite and disease problems may be reduced. Many different crops can be used with this practice, as long as legumes or brassicas are available in the field or adjacent fields. Some examples of grains that can be self-harvested by hogs are wheat, rye, oats, dent corn, Grohoma sorghum and Spanish peanuts, or popcorn (20). Such direct harvesting can sometimes turn a profit from even a low-yielding grain crop (21).

In any type of pasture used in hog production, it is advisable to inspect the pastures for any potentially toxic weeds that can be poisonous to hogs, including pigweed, Jimson weed, two-leaf cockleburs, young lambsquarters, and nightshades. The veterinary and county Extension agent should be able to help with weed identification (22).

If pastures are not an option because of the farming situation, addition of a forage or by-products to the rations are another possibility. Honeyman explains that studies show that fibrous feeds and protein by-products can make up as much as 90 percent of gestating sows' rations, because of the sows' lower energy needs and large digestive tracts. Acceptable feeds include alfalfa hay (need to feed a good quality hay because moldy alfalfa can cause abortions), haylage (not more than 20% of a sows ration), alfalfa and orchardgrass hay, grass silage, sunflower and soybean hulls, distiller's grains, corn gluten feed, corn-cob meal, and beet pulp.

Honeyman says even growing and finishing pig rations can be 10-30% forages; if energy levels are maintained (23). But use caution when using distiller's grains and corn gluten feeds because there are large variations in the nutritional value of these products and these nutritional variations may cause problems.

Small grains and alternative grains can be used to reduce the amount of corn in swine rations.

Wheat and triticale can totally replace corn, but they both need to be more coarsely ground than corn to reduce the dust and flouring effects. Wheat has a feeding value of about 107% of corn.

Both wheat and triticale can reduce the need of some soybean meal and DiCal Phosphate in the ration. Light wheat, light triticale, or weedy small grains that would be discounted at the elevator can both be used with no difference in pig performance. A ration that includes triticale should be balanced for lysine, not the crude protein content. Some other small grains to consider are oats, barley, and rye.

Several other non-small grain crops that can be used in hog rations are sweet white lupines, buckwheat, and popcorn. Sweet white lupines can be used to make up to about 10 percent of ration for most finishing and gestating animals. Lupines should be supplemented with iron at 400 parts/million. Buckwheat can be used to replace about 25-50% of corn. Buckwheat has only 80% of the energy value of corn, but higher fiber content; it can be planted later in the season as a substitute crop in emergencies. Buckwheat should not be used for the nursery rations or lactating sows because of their higher energy requirements. Popcorn has nearly the same nutritional value as yellow corn and if you happen to be in an area where cull popcorn is available, popcorn can sometimes be less costly than corn.

Soybean meal can also be replaced or reduced by the use of alternative protein sources.

Canola meal can totally replace soybean meal, but the ration may need to be formulated to take into account the lower digestibility of lysine in the canola meal. Addition lysine will probably be needed. Roasting or extruding whole soybeans is another option. These

heating processes break down the trypsin inhibitors found in uncooked or raw soybeans. The producer can use green, frost damaged beans that would be discounted at the elevator without any problems in the ration. The higher oil content of whole processed soybeans gives a faster rate of gain than soybean meal. The cost of processing equipment and the fact that these products don't store well are considerations that the producer has to take into account.

Food industry or restaurant wastes are another alternative food source that can be utilized. Pigs make excellent scavengers of what we would consider a waste material. Food industry wastes from dairy processing plants, vegetable processors, and bakeries or restaurant wastes from pizza parlors, grocery stores are all good sources of these wastes. Many of these businesses are glad to have someone get their waste products and utilize them. Most businesses want regular pick-up of the materials, and usually require the farmer to supply storage bins. But remember it is against the law to feed any waste food product to pigs without first cooking it for the required temperature and time (21). Check with your state Health Department for requirements.

Remember that any changes to your rations, including adding alternative feedstuffs, may change the rate/gain in finishing hogs. It is best to determine the feed cost savings and changes in marketing patterns before making any corrections in your feeding program. Always have any ration changes checked so that the pigs' requirements are being met at each state of maturity. These alternative feed ingredients have various feeding values, so it is advisable to check with a swine nutritionist or Extension agent to formulate a balanced ration for different swine weights and groups. The *Feedstuff Magazine Reference Yearly Issue* (24) contains feeding values and analysis tables for many by-products and unusual feeds.

Odors

According to R. Douglas Hurt, director of the Center for Agriculture History & Rural Studies at Iowa State University:

Hog odor is the most divisive issue ever in agriculture, damaging the fabric of rural society and disenfranchising pork producers from their communities, even on the roads in front of their farm (25).

Farmers must become more concerned about how odors are affecting their neighbors, even new neighbors in subdivisions.

Most complaints about hog operations involve odor problems. Odor should be on the minds of every hog producer. Many hog farmers are finding that their odor control efforts are not meeting their neighbor's expectations. People's acceptance of odors seems to be changing. One of the main problems is that there is no consensus or agreement between farmers and neighbors or any part of industry and the public on how to evaluate odors that can cause negative reactions from people. Farmers must also be current on county zoning laws, Right-to-Farm laws, and other local and state laws affecting land use. Many neighbors will be tolerant of occasional odor problems, but if odor persists or is fairly frequent, trouble will arise.

Odors are considered a nuisance only when their intensity and character are sufficiently objectionable to get complaints from neighbors. One legal basis for the nuisance concept is that people should not use their property in such a way that it would interfere with the adjoining property owners use of their property. Odors from hog production systems are regarded as nuisance pollutants not regulated under the Clean Air Act. Even if these odors are non-toxic, they do affect how people feel and react in their communities.

Something else to consider is that dust from livestock buildings can also affect how your neighbors perceive your hog operation. Dust in hog buildings comes from feed, bedding material, manure, and even the hog itself. Some of the factors that can affect dust and odor levels are animal activity, temperature, relative humidity, wind, stocking density, feeding methods, as well as the feed ingredients

themselves. Dust can carry gases, manure particles and odors.

A farmer cannot create an odor-free or dust-free hog operation. Common sense, as well as talking to and listening to your neighbors, is probably your best defense against odor and dust complaints. Farmers should concentrate on sound management practices before trying any extreme measures.

Some manure handling procedures that may enhance a good neighbor odor policy are:

- 1) Don't apply manure to fields close to your neighbors' houses,
- 2) Apply manure on cool days, or early mornings when temperatures are coolest (gases rise and dissipate faster),
- 3) Don't spread manure when wind is blowing toward neighbors' homes,
- 4) Inject or incorporate manure into the soil ASAP. Slurry tankers and injection equipment use are probably most effective for reducing odor problems in liquid manure disposal, even if these methods reduce the time period when manure can be applied to the soil.

When constructing a hog building, try to stay at least a quarter mile away from a neighbor's house. Also try to store manure out of sight behind buildings, or try putting up shelter belts or grass berms to hide your manure handling sites. Any of these fairly simple procedures may help improve your relations with your neighbors.

Waste Management

The management of manure and wastewater is essential in a sustainable approach to swine production.

Waste management goals in sustainable hog production are to enhance on-farm nutrient cycling and to protect the environment from pollutants. These resources hold valuable nutrients that should be recycled back into the

farm system. When used to their full potential, these materials yield substantial savings in purchased fertilizers and lead to improved soil fertility through the benefits of increased soil organic matter. Increased public awareness of the potential threat to water quality posed by hog manure has prompted regulatory actions at local, state and federal levels. Hog farmers must keep informed in order to avoid violating these regulations.

Pasturing of hogs is one system of waste management. The hogs distribute the manure themselves in pasture operations. With proper rotations and selection of stable, non-erodible lands, streams or waterways, the hazards of pollution are small, and parasite and disease transfer is reduced. The pasture loading rate varies greatly with climate, forage type, and rotation schedule. The vegetation of the pasture will be the main indicator of the proper stocking rate.

Another system of waste management is the use of paved or unpaved open-lot operations, with or without housing or shelter for protection and shade. Runoff contains high pollutant levels and must be managed in order to prevent contamination of nearby surface or ground water.

Manure from open lots is handled like a solid. Manure is scraped to reduce buildup, as well as to help control odor and fly populations. Scraped manure is usually either stockpiled for field spreading later, spread immediately on the field or composted. Composting of manure is a strategy that allows for long-term storage with reduced odor and pollution problems and allows for the production of a superior soil amendment. ATTRA's *Farm-Scale Composting Resource List* provides additional resources available; contact ATTRA again to request this resource list.

With pasture, open lot, or confinement hog operations, if hog waste is not handled properly, or if runoff is not controlled or well managed, water quality problems can be created.

Devising a waste management plan for a farm must be done on a tailored, site-specific basis. The Natural Resources Conservation Service

(NRCS) has information to help set up this type of management plan. Contact the local county office for further information.

The U.S. Department of Agriculture (USDA) and the Environmental Protection Agency (EPA) developed the Unified National Strategy for Animal Feeding Operations (AFOs). The final version was released March 9, 1999, and is a strategic plan on how the federal government expects to address water quality issues in regard to livestock feeding by the year 2009. The plan will include actions to prevent or reduce runoff, and improve storage and handling of manure. The final version of the plan is expected to require 15,000 to 20,000 additional livestock operations to operate under concentrated AFO permits (26). The strategy requires large livestock companies that contract with smaller operators to share responsibility for meeting regulatory requirements. The strategy is on the Internet at <http://www.epa.gov/owm>; from EPA at (202) 260-7786; or the USDA at (202) 720-5974 (27).

Crop Nutrient Management

No matter what type of swine operation is used, manure can be the primary nutrient resource for crop production on the farm. ATTRA's *Sustainable Soil Management* publication discusses concepts and practices critical in soil nutrient management and in planning a farm's individual fertility program. The NRCS also provides reliable information on nutrient planning strategies.

Using manure as a source of plant nutrients for the production of forages, small grains, or other crops requires attention to several key principles. The first of these is the determination of nutrient levels in the soil and manure through accurate testing. Nutrient contents of manure will vary tremendously depending on storage conditions and animal feed regimes. Nutrients that are already present in the soil, as well as those from previous manure applications must be taken into account.

Manure application rates should be based on crop needs (figures should be available through

the Extension Service or a soil testing lab). It is advisable to determine manure application rates based on those nutrients that are present in the manure in the highest amounts. Basing application rates on manure nitrogen content alone should be done with care since this can sometimes lead to soil nutrient imbalances if other macro- or micro-nutrients become excessive.

It is best to incorporate manure into the soil as soon as possible after spreading to avoid additional losses of nitrogen. Spreading manure on frozen ground should be avoided to prevent runoff. Manure spreaders or liquid manure spraying equipment should be properly calibrated. The county Extension office has information on these operations. In some areas it is possible to hire someone who does custom manure spreading and who has the equipment necessary to do the job properly.

Health

Pigs produced on pasture are usually healthier than pigs produced in confinement. Pastured hogs often have fewer problems with respiratory diseases, rhinitis, and foot and leg problems (23). A 1978-79 survey of Missouri hog producers demonstrated that hogs raised on pastures had the lowest health costs. Hogs raised in a mixture of pasture and confinement had the highest health expenses. This suggests that the hogs had a difficult time adjusting from one type of facility to another (28).

Antibiotic use is a controversial issue in swine production, especially when used at subtherapeutic levels to prevent disease, promote growth, and improve feed efficiency (1). There have been many studies on whether bacterial resistance to antibiotics induced by feeding antibiotics to livestock is transmitted to human pathogens, but no conclusions have yet been reached. Some scientists as well as other people believe there is a risk with the widespread practice of feeding antibiotics. The priority in sustainable swine production should be on prevention and disease eradication, rather than on disease treatment.

In 1999, the Veterinary Medicine Advisory Committee to the Food & Drug Administration (FDA) approved a new risk-based process of evaluating new antimicrobial drugs for use in food-producing animals. This is a response to determine if on-farm use of antibiotics could lead to the build-up of resistance in humans and a loss of products to fight infection (29). Also, effective December of 1998, European authorities prohibited the use of four feed antibiotics. These two events have increased the uncertainties for animal health companies to discover, develop and market new antibiotics for animal health (30).

Probiotics (live, beneficial bacteria)—available as gels, drenches, dry mixes, or for use in water—are used to replace or supplement naturally occurring gut microbes during times of stress or disease. During stress, such as weaning, shipping, weather or feed changes, the population of beneficial and pathogenic microbes can fluctuate, changing the balance in the intestinal tract (31). Research on the use of probiotics is not conclusive. Probiotic firms suggest that in laboratory conditions the stress is not enough to conclusively demonstrate the value of probiotics. Dr. Austin Lewis, a swine researcher at the University of Nebraska, suggests that this assumption may be accurate, because laboratory conditions usually demonstrate a lower response to antibiotics, too. Many farmers have observed the benefits of probiotics in their everyday experiences, but finding research to support probiotic use is difficult (32). Since probiotics must be live to work, they need special care. Heat, moisture, oxygen, and time can all reduce the viability of the probiotics. It is also important to remember that antibiotics can kill the probiotic's beneficial bacteria as well as pathogens, so it is best to check product compatibility.

The type of production system used affects human health. Respiratory problems may be increasing for hog farmers who use confinement hog houses. David Schwartz, University of Iowa pulmonary specialist, says workers in confinement units are more prone to upper-respiratory disorders than blue-collar workers in general. The lungs of workers in confinement systems frequently are inflamed due to irritation

from grain dust, airborne particles of fecal matter, hair, feed, and other debris.

Ammonia, hydrogen sulfide, carbon dioxide, and carbon monoxide are gases from hog manure that may be concentrated in confinement barns. Stephen Mallinger, deputy director of technical support for the Occupational Safety & Health Administration (OSHA), believes ammonia and other common confinement gases often exceed permitted exposure levels (PELs) for general industry (33).

Outdoor hog production has problems also. Working outside in the cold, heat, rain, snow, wind, and dark are not always pleasant. Dave Odland, farmer at Clarion, Iowa, says, "With my system you have to be willing to get up at 3 a.m. to keep squealing pigs out of the mud and rain. And, you have to be able to take those days when you lose a litter or two because of the weather" (34). Tim McGuire, farmer at Wisner, Nebraska, comments that from November to March, they do not feed hogs outside because it is too difficult to keep water, heaters, straw, and feed in place (35).

Humane Concerns

Sustainable pork producers need to consider how the general public (the consumer) views their operations. Confinement finishing and gestation buildings that restrict movement and interaction between pigs may become targets of media attack in the future. Tom Garrett in an article in *AWI Quarterly* states, "Gross abuse of farm animals, on a scale and to a degree unimaginable a generation ago, is the distinguishing feature of industrial agriculture." In this article, Garrett quotes *Hog Farm Management Magazine* as stating "Forget the pig as an animal. Treat him just like any other machine in a factory. Schedule treatments like you would lubrication. Breeding season is the first step in the assembly line (36)."

The producer must choose a production system that meets not only the demand for profit, but also the producer's and the public's humane concerns and demands for safe food, as well as a clean environment. Economics, environmental concerns, and humane treatment may conflict, so

it is usually up to the producer to reconcile these issues in his operation.

Summary

A sustainable hog operation is not an end in itself. All aspects of farming are tied together. When you are producing pigs in a sustainable manner, you are using all parts of your farming operation. The manure or compost is used to help produce the diversified crops that feed the hogs. Legumes are also used to help feed the livestock as well as adding nitrogen to the cropland. Animals are treated as living organisms, not just a part that will be used to make a product. The family is involved in the whole farming environment and sees itself as a part of the community. Sustainable agriculture sees itself as the interaction between the different aspects of farming; it is not individual parts, but the interaction among all parts that make up the whole farming operation.

It is not possible to cover all of the low-cost, sustainable hog production practices being used by U.S. farmers in this publication. For additional information on any subject mentioned in this publication, or for any information on any other aspect of sustainable hog production, please call ATTRA again. Conventional swine production information is available from the USDA Cooperative Extension Service and the Department of Agriculture in each state.

Sources of Further Information:

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The 1999 three-ringed binder entitled *Swine Sourcebook: Alternatives for Pork Producers* is an excellent collection of scientific publications, popular press articles, and on-farm examples of sustainable swine production; hoop structures, pasture systems, and many other areas. To order, send a check or money order made out to the University of Minnesota for \$17.50 plus \$4.00 for shipping to:

Distribution Center
20 Coffey Hall
1420 Eckles Avenue
St. Paul, MN 55108-6069
(800) 876-8636
Item number is PC-7289-S

The Center for Rural Affairs, an unaffiliated non-profit organization in Nebraska, has been serving and advocating for America's family farm and rural communities for 25 years. They are committed to building communities that stand for social justice, economic opportunity, and environmental stewardship. Their monthly *The Center for Rural Affairs Newsletter* covers issues important to agriculture and rural communities. Many of their publications deal with livestock, especially pork production. Some of these publications are:

Spotlight on Pork III

A 1998 special report on the industrialization of the pork industry that gives a state-by-state account of the fight against large-scale hog facilities. 16 pp. #Q8, \$3.00

A Call to Reason: Taking Action for Responsible Pork Production

A 1997 report that explains what individuals and communities can do when a large corporate hog operation proposes to move into the area. 16 pp. #V2, \$5.00.

From the Carcass to the Kitchen: Competition and the Wholesale Meat Market

A 1995 report that addresses how wholesale meat is priced, changes in the retail grocery market, who

has market power, legal issues regarding anti-competitive behavior and policy recommendation. 52 pp. #Y7, \$10.00.

Spotlight on Pork II

A 1995 comprehensive look at corporate farming in the hog industry, and its effects on pork producers, rural communities, and the structure of the industry. 16 pp. #Q2, \$2.00.

Fit for a Pig. Low-Cost Sustainable Strategies of Resourceful Hog Farms

A 1991 look at practices of 10 low-cost, sustainable livestock farmers/families. 46 pp. #Q5, \$7.00.

Pork, The Other Producers: A Better Way to Raise Hogs

A 1997 40-minute video that examines production systems requiring lower amounts of capital – especially important for beginning farmers – as alternatives to large-scale, corporate structure of production. #V3, \$10.00.

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The Land Stewardship Project, founded in 1982, is a private, nonprofit membership organization devoted to fostering an ethic of stewardship toward farmland. The *Land Stewardship Letter* is a bimonthly publication sent to all members. Annual membership is \$30.00. Several publications dealing with livestock are:

Killing Competition with Captive Supplies

This is a 1999 special report on

how meat packers are forcing independent family hog farmers out of the market through exclusive contracts. The price is \$6.00 (Minnesota residents add sales tax), including shipping.

An Agriculture that Makes Sense: Making Money on Hogs

This 1996 publication describes and analyzes a 50-sow sustainable hog enterprise in Minnesota. The price is \$4.00 (Minnesota residents add sales tax), including shipping.

Land Stewardship Project
2200 4th Street
White Bear Lake, MN 55110
(651) 653-0618
Website:

<http://www.misa.umn.edu/lsp.html>

The Sustainable Farming Connection website at <http://sunsite.unc.edu/farming-connection/> is managed by the former staff members of *The New Farm* magazine and provides information on the latest news from the sustainable farming community.

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Columbia, MO 65201
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Box 477
Pittsboro, NC 27312
(919) 542-5704
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PO Box 280
Conrad, IA 50621
(515) 366-2124

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