Manure Odor/Fly Management

Engaging the Farm's Ecological Advantage

by JAMES C. SILVERTHORNE

Now is the right time to modify fly prevention programs with this natural linkage in mind: Manure odors and fly populations are at their highest levels during summer's warmth.

During summer in livestock shelter areas, with even small accumulations of fresh and decaying manure, the odor-fly relationship is causative as manure and urine odors attract some types of flies. Two corollaries to this dynamic include: Fresh air, free of manure odors/volatiles, does not attract flies, and manure not producing odor does not attract flies.

Can an ideal manure management-fly prevention program for livestock shelter areas exist in farm practice? The ideal program results in a livestock shelter area (barn, stables, loafing shed) so free of flies, full of fresh air and chemically safe that one could comfortably picnic there with family and friends. Our image of ideal success – the livestock shelter as picnic zone – guides us to its establishment in the real world. What are the most effective foundational materials and methods for the ideal manure odor-fly prevention program, our "castle-in-air" picnic zone?

REAL FOUNDATIONS

They are: (1) a cluster of standard low-risk fly-prevention tools to decrease an existing fly population. Several weak items working together can support each other's actions; (2) an emphasis on decreasing fly attractant levels typical in livestock areas (the volatiles produced by manure, urine, decaying bedding material and spoiled hay/feeds), thereby preventing fly population increase and usually ensuring its decrease. Decreased concentration levels of fly attractant volatiles also make the program easier to accomplish by decreasing the need for the prevention items in (1). Further, with consistently very low levels of manure's attractant volatiles, area fly traps' attractant baits become relatively more effective.

EFFICIENCY OF THE ECOLOGICAL ADVANTAGE

Prevention of manure odor production yields direct and indirect effects. Fresh air is a direct effect. Indirect effects are many, exemplifying a farm's *ecological advantage*. I introduce here my novel use of the term to signify a farm ecosystem's amplification of the value of input's direct effect – amplification evidenced by proliferation of indirect effects and accomplished by system interactivity.

The more interactive a farm's biochemical components are, the more numerous the possible indirect effects of an input action, the greater is the efficiency of the farm's ecological advantage.

Functional connections (interactivity) throughout a farm comprise its ecological advantage. The output total value of combined direct and indirect effects can greatly exceed input costs on a farm with a high ecological advantage efficiency rate.

An ecological advantage is most available in well-functioning, complex, semi-closed biological systems such as today's sustainable farms. Their robust efficiencies make them biologically, environmentally and financially sustainable.

MANURE ODORS ATTRACT FLIES

Manure odors attract flies (MOAF), a natural dynamic. Managers will be happy to learn that establishing fresh air at livestock shelter areas is

PHOTO COURTESY OF CRANBERRY CREEK FARM

Cranberry Creek Farm goats enjoy clean air at their newly bedded SRP-treated pen.

the single most effective safe method *and* material for decreasing the local fly population, as I and others have found. Air free of fly attractants makes an associated fly prevention program more efficient.

Importantly, flies will not develop genetic resistance, or become desensitized, to the absence of odorous attractants. For flies, certain odors/volatiles (other than pheromones) comprise the attractant signal. Fresh air, containing no such signal, is background "noise."

During fly season at most livestock shelters throughout the United States, a continuous absence of manure-generated fly attractants can greatly decrease the necessary applications of fly insecticidal agents (USDA: 200 tons per year, plus or minus 25 percent). As much as 80 percent of that amount (more study needed) may be eliminated by preventing production of fly attractant manure odors. Areas free of odors attract fewer flies, meaning fewer targets for insecticide application which leads to lower insecticide volume applied. This results in lowered toxicity threats to the farm's human, animal and nearby wildlife populations and lowered costs for the farm.

For fresh air to be a fully successful fly prevention material-method, odor concentration levels at manured areas need be almost imperceptible to human olfaction. Maintaining this status is not usually difficult but requires continuous attention.

Benefits of Fresh Air at Livestock Shelters

- Increased air freshness/purity of air = decreased threat to animal and human worker health
- Decreased ammonia gas emission (N loss from manure/urine and its compost)
- Decreased emission of hydrogen sulfide, skatoles
- Possible decreased emission of carbon dioxide, methane, nitrous oxide
- Improved soil structure/fertility from compost = improved grass/crop growth = supports herd health
- Decreased fly-attractant volatiles including odors = decreased local pest fly population = decreased volume insecticide application = decreased toxicity threat
- Decreased fly pop. = increased animal health + decreased amount of maintenance feed
- Decreased fly pop. = decreased manure N loss by fly larval consumption of manure N
- Decreased liability of governmental regulatory violations
- Increased good neighbor relations

NOT STATING MO-AF

Normally, sellers of manure odor production prevention products would clearly state the MO-AF dynamic in their advertisements, brochures and labels. Normally, advertisements proclaim every benefit of a product's use. Since around 1971, its sellers have been prohibited by EPA's Office of Pesticide Programs (OPP) from stating, "Manure odors attract flies" unless the product went through the registration process to become an EPA pesticide allowed for sale.

However benign a product's ingredients, OPP has long found that the MO-AF phrase itself (an implication of an indirect effect) would cause the product to become an EPA pesticide. Reasonably, sellers have not taken on the burdensome registration process, more appropriate for toxic ingredient products.

Yet, those of us who do not sell or distribute such products have never been legally silenced by EPA. We may continue to speak of manure odor's fly-attractant property in detail, even go on and on about it as I do.

EPA PESTICIDE-SPEAK

With very few exceptions, EPA legally defines any *commercial* product as a pesticide product when the product claims in label and/or advertisement to do any of the following actions to a pest population: "… prevent, destroy, repel, or mitigate." The product sold with such a claim is legally required to be registered as a pesticide.

My recent check with EPA-OPP on present status of its policy yielded a surprising and welcome development. No longer does a MO-AF statement accompanying a product necessarily cause the product to become an EPA pesticide. Now, with some OPP review and guidance, the product with such statement might not be seen as a pesticide and thus not require EPA registration for its sale.

As I understand from communication with Catherine Milbourn, Press Officer at EPA's Media Office, each likely seller desiring to include the former troublesome phrase or its equivalent should request an OPP review of the product for official determination of being a pesticide or not. To begin a review of a manure odor production preventing product with all its proposed descriptors (label, ads, images), contact EPA-OPP ombudsperson Nicole Berckes at 703-308-0152 and/or *berckes.nicole@epa.gov*.

Also, check in with your state's pesticide division. States differ in willingness to impose constraints on availability of relatively benign agents. A state might make certain demands even on a product OPP has determined is not a pesticide.

GRACEFUL STUMBLING

Even after 30 years of working with diligent livestock managers, lots of animals, often smelling plenty of manure odor and seeing lots of flies, I had not figured out the dynamic in front of my nose and eyes. Nor had I known of any manager, veterinarian or university specialist identifying a barnyard's odor as a large area fly attractant or fresh air as a fly prevention method. I never heard, "It's the odor here that keeps the flies here." Then, with uncommon good fortune, I chanced to relate a manured area's local fly population to its odor production.

Humans sense most of manure's odorous attractant volatiles as malodors. But, flies appreciate such volatiles as charming invitations to visit their source and stay there, forever it can seem. I discovered that some biocompatible materials and methods can decrease and almost eliminate fresh and decaying manure's capacity to produce odor, ending the flow of invitations to flies.

At a biological agriculture seminar given in 1981 by Carey Reams and Dan Skow, D.V.M., which I saw advertised in *Acres U.S.A.*, I learned of a natural mineral compound's capacity to decrease a manured area's fly presence. Reams told us that soft rock phosphate dusted onto manure can prevent most of a local pest fly presence.

I had come to the seminar with that very concern about my horse stable management. I needed an effective, non-toxic, easy to use way or agent to greatly decrease pest fly population in the stables building and its barnyard. Therefore, I listened intently to Reams tell our group of farmers something like, "So that flies will not be a problem in the chicken houses, just dust soft rock phosphate onto the surface of accumulated manure. No need at all for toxic fly control agents."

Reams had commented on fly riddance and prevention around poultry manure in chicken houses as an afterthought on a side issue. He did not say *how* soft rock phosphate rids a manured area of flies. He did not mention that it abates manure's odor production, nor did he say how frequently to apply it.

Biocompatible Materials & Methods for Prevention of Manure Odor

- Air dispersal, active and/or passive
- Removal of manure
- Absorbent bedding materials, including finished compost; a dry surface does not evaporate moisture carrying its odor components
- Minerals: natural compound powders
- Biological: bacterial, enzyme solutions; plant derivatives; dung beetles

FANATIC FOR FRESH AIR

Returning to my farm, I soon obtained and dusted soft rock phosphate onto the stinking manure packs in the sheltered loafing areas and outside barnyard. Being late spring, the area already had lots of flies. Within fewer than three minutes after application, odor production stopped. At first, I didn't know that production had stopped. I had not expected it. I had only expected the fly presence to decrease, somehow, somewhat, sometime. Then, I became certain that I no longer smelled the previously constant malodor. I walked around on the treated manure pack. The air over this manured area had become cleaner, actually fresh. It stayed fresh.

Standing in the midst of the mystery that early afternoon, I understood that the newly odor-free, fresh air would attract no flies. That was the bio-mechanism, not indicated at the seminar, of Reams' fly prevention method.

I knew that connection because I had earlier read USDA entomologist researcher Philip S. Callahan's *Tuning into Nature* (1976) and his later articles in *Acres U.S.A.* on insect detection capabilities of certain signals. From Callahan's writings on insect attractants and Reams' confident assurance of fly riddance, I then perceived that the anticipated effect (fewer flies) would most likely be caused by the quickly and greatly lowered concentration level of odors from the treated manure.

The effect of fewer flies relies on their keen detection of manure odor to guide them to its source – that being critically important to their survival and reproduction. Where the signal is almost absent, little or no attraction to a viable residence (manure) can occur.

FRESH AIR'S FIRST INDIRECT RESULT

The manure's odor production dropped by an estimated 90-plus percent of the previously produced fly-attracting gasses. The pest fly population dropped by an estimated minimum 80 percent of its previous average level. As reported to me, similar large changes have been confirmed by managers in other locations.

Not producing attractants, the treated areas were then in stealth mode to flies' detection capability of preferred homesite. The two odor-free manure packs (totaling 1,400 square feet) and barnyard (1,000 square feet) of fresh and decaying manure and urine had become "hidden" to flies, producing no pertinent signal for them, now being merely part of environmental noise.

I have focused on soft rock phosphate (most often applied to crop soil) because it was the first material I used. Years later, I observed and heard that other equally effective, biocompatible odor production abatement agents also yield similarly decreased populations of flies at previously odorous sites.

VOLUNTARY CROWD DISPERSAL

In the wild, flies usually have a selection of differing concentration levels of attractant odors. Flies are typically more attracted to the source of the higher concentration level of appealing volatile/signal.

Prior to applying soft rock phosphate at my stables, I had accomplished very few pest fly prevention measures other than hanging sticky paper and spreading soft wood shavings onto the manure packs' high moisture spots.

By my lack of adequate action, I maintained an often stinking shelter area full of flies. Even though the horses were out to pasture from evening to early morning, I was much concerned with the situation. Wouldn't some exposure to insecticides (by periodic premise fogging) be less stressful to the horses than all the flies? But, the situation of much odor production

and many flies unexpectedly turned out to be a best-ever historic control (before and after) for that first soft rock phosphate application experiment.

To maintain the new decreased fly population level, all heavily manured areas needed treatment to prevent odor production. Mid-summer times in northeast Pennsylvania, I found that 40 pounds of soft rock phosphate sufficed to treat at 5- to 6-day intervals about 1,400 square feet of indoor, unbedded manure pack (1.5-plus feet deep) freshly increased daily by 10 horses. About 100 pounds of soft rock phosphate were required per horse per year.

During spring and fall, applications were required only once every two or more weeks. Succeeding applications were made on an as-needed basis, determined by the return of a very slightly detectable presence of manure/urine odors, usually that of ammonia.

Some suppliers of soft rock phosphate for prevention of odor production from sheltered, bedded areas, suggest applying amounts averaging 2 ounces per day (less than ¼-cup volume) for an 800-pound animal, or 45 pounds per year. Spot treatments can also be made with other natural minerals, bacteria-enzyme solutions and the farm's own well-decayed compost.

Because I almost always kept the horses at liberty, the dirt-based barnyard between the two shelters was also heavily manured. Effective soft rock phosphate treatment for that area worked out at about one-quarter the frequency of the indoor loafing area manure packs.

Application of the mineral powder by dusting from a grain scoop to the surface of the manure packs required 10 minutes, maximum. Applied to fresh manure, as some managers do in dairy barn gutters or on loafing areas as I have done, it prevents malodor production rapidly. Treated manure's absence of odor production continues later in the compost heap. Containing approximately 20 percent each of phosphate and calcium, soft rock phosphate added to manure increases the manure's fertility. When heaped for composting, treated manure's decay processes appeared to be normal, except for the absence of odor production. Much of the manure's native protein/nitrogen component is thereby presumably retained within the heap (more study needed) as feedstock for beneficial microbes and worms until the compost is added to crop or pasture soil.

When applying soft rock phosphate always wear an appropriate dust mask to prevent inhalation of the fine particles and wear appropriate eye protection to prevent irritation. When spreading soft rock phosphate-treated manure, or any manure/compost onto land, avoid locales near waterways into which rains may cause runoff of manure/compost.

FOWL FEED'S GOURMET PROTEIN

Fresh air (more than a cosmetic nicety) does not attract flies – that's the core of all efficient fly prevention programs. It's particularly valuable for those with low-risk insecticidal agents. Other items in a program are add-ons, important to be sure, yet secondary to keeping the strongest "scent" around livestock shelter areas that of fresh air.

Barn swallows, wasps and bats patrolled the airways. On the ground, well-known for their keen and unending appetite for high-protein insects, guinea fowl accessing manured areas hunted both ground-traveling adult pest insects and their slightly buried eggs and maggots. The stable fly population was lowest at my stables when I not only prevented manure odor production but also allowed five or so guineas to police at liberty a total of 2,400 square feet of heavily manured area.

CRANBERRY CREEK FARM

Jeffrey and Mary-Jean Henry began dairy goating in 2007, near Cresco, Pennsylvania, with five Nubians. They built the herd to 60 does, recently sold them all and are now rebuilding with 18 registered Alpine does so far. The farm retails all the chevre cheese it can make.

Focus: By late summer 2013, Jeff began periodically dusting the goat pen's soiled wheat straw bedding with soft rock phosphate at the rate of about 25 pounds to 900 square feet. With the first application, Jeff observed that the manure and urine odor levels decreased greatly. The very low to undetectable levels continued for about seven days, then slightly increased. He noticed fewer flies, particularly the house or filth fly. However, although lower than before, a greater than acceptable number of stable flies, a biting type, remained.

Comment: When I last visited the farm in late August 2013, temperature of 73°F., I deliberately left my parked car's windows open. I whiled a pleasant hour and half at the goat barn interrogating Jeff on his procedures past and present to adequately manage, or not, manure odors and pest flies. During that time, I noted low concentration levels of both odor and flies. Returning to the car, I was surprised by how few flies were inside, counting only seven. In summers past, while visiting the farm's then somewhat smelly goat pens, an almost unbearable quantity of flies would fill the open-windowed car (all tests having same car, same parking location, similar weather).

Future: Jeff considers making a quick application by sponge of a dilute herbal repellent to the goats'

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lower legs at milking times. A future adjustment will be increasing the distance from the barn to the compost windrows of spent bedding/manure from only 50 feet to at least 150 feet. Currently located so close to the barn, the decaying materials could be the local "factory farm" for stable flies. At this writing, most of that material came from manure and litter not treated with SRP. With the SRP prevention of odor production, he estimates that manure and bedding removal can be done at two-week or longer intervals.

Local ag extension personnel will definitely advise him to place pheromone traps and fly-predator wasp eggs close to the compost windrows.

PHOTO COURTESY OF LAINI FONDILLER

Alpine goats at Lazy Lady Farm in Westfield, Vermont.

LAZY LADY FARM

Laini Fondiller began her northern Vermont dairy goat farm in 1989 with four goats. Now she breeds and sells registered Alpines, milking 40 goats. She makes and sells cheeses of legendary quality. During the early 1980s, she had apprenticed at various livestock farms. For two of those years she was a *stagiaire* (apprentice) at farms throughout France. There, she first learned about intensive rotational grazing. She did a lot of underpaid or unpaid work in order to learn from other people's successes and failures. A failure item, in her eyes, was their non-ecological fly control. She has changed all that at her farm.

Focus: The farm developed a successful manure and fly management program, virtually eliminating pest fly aggravations around the animal shelter area.

Lazy Lady Farm's basic fly control program:

- Obtain adequate quantity of required supplies of preferred sticky trapping material ahead of the season.
- Start early!
- Important: "Know the fly" – observe flies' habits, resting areas to ensure strategic placement of the sticky material. If not catching many flies, adjust sticky ribbons' locations and/or change brands to the needs of your operation.
- Remove manured bedding completely twice a week. Get into corners with a hoe; remove all spilled feed.
- Move spent bedding and manure to a location distant from the animal shelter. Turn the heaps twice in summer.

The sticky traps she favors are the reel type and the "curtain" type. She will place a 4-inch section of the curtain material directly in sunlit areas on cleaned floors where flies often land. Same reasoning for their placement across windows with morning sunlight. Fondiller emphasizes that success with her program requires continuing attention to the particular setting in which it's applied. Observe your flies in your barn – learn their habitual resting places because those are the high-yield places to position the sticky ribbon traps. For example,

PHOTO COURTESY OF MICHAEL W. DUPONTE

No farrowing crate is necessary with the inoculated deep litter system in action.

Fondiller saw that indoor flies at night "roost" high up from the floor. Accordingly, she places reel type sticky ribbon at or near the ceiling for the entire length of the enclosed area.

Comment: The goats are not bothered by the remaining low population level of flies. She, her goats, the nearby bird population and her farm's natural locale are not subject to insecticidal toxins. She says a parked car with open windows near the animal shelter area nowadays collects no flies.

Future: Fondiller says it took her a long time with many adjustments to develop her program that now works so well. She wants other managers to know that success is possible.

PHOTO COURTESY OF CRANBERRY CREEK FARM

Jeff Henry demonstrates official application form of soft rock phosphate.

TUSSOCK SEDGE FARM

Henry and Charlotte Rosenberger established their cow-calf beef farm in 1990, having currently 550 acres in multiple tracts near the village of Blooming Glen, Pennsylvania. They manage their all grass-fed cattle herd (total about 300) without the conventional inputs of typical beef cattle operations. The farm retails packaged meat from its 80-90 finished animals per year. They routinely sell out. Buyers comment not only that they really like the meat's flavor, they also approve of the farm's humane raising of livestock, and they appreciate that the farm's environmental stewardship is so evidently conscientious.

Focus: The farm has 27 paddocks, each about 9 acres, often bordered by woods, with terrain that can be traveled by tractor for grass clipping to about 4 inches height after having been grazed. Henry places 50-150 animals on temporarily fenced areas of 3-4 acres. Each temporary area is grazed to no lower than 4 inches of grass height, or for one day, four to six times during the season.

As cattle pass through gatings between fenced areas, they are inspected for fly concentration and lightly sprayed, if necessary, with a pyrethrin solution (permitted for use in dairy milk houses). A newly entered paddock, not yet having a concentration of manure, will have fewer flies than the previous one. Next are the many birds on the farm with their natural habitats of forest and wetland kept intact. The local Girl Scout Troop made and placed 40 birdhouses occupied by Bluebirds and Tree Swallows. Cow birds abound, often perching on the cattle awaiting arrival of a few more morsels. Grazing conditions provide abundant fresh air ventilation for dispersal of any manure odors generated at the newly grazed areas.

Comment: During recent years, the herd's yearly incidence level of pinkeye is usually zero. Henry's management approach is to avoid getting in nature's way. Its operation reminds us of how well it can go for both animals and humans when we adhere closely to natural guides.

Future: Having observed higher than acceptable levels of fly populations on the animals at the watering stations, he will take the advice of other stockmen with a similar situation by locating baited fly traps adjacent to those areas.

NEW OLD PIGGERIES

Now we visit not a single farm but a large group of family-sized farms, 40-plus on the islands of Hawaii, accomplishing a new increase of swine production by a modernized version of Korean natural farming (KNF). This swine housing method, known as the Inoculated Deep Litter System (IDLS), prevents production of manure odors which helps prevent proliferation of pest flies. The system successfully addresses the typical problems of animal confinement. It is also used where access to pasture is available.

KNF was developed by the Korean teacher, Han-Kyu Cho. It has been described as a highly efficient and productive version of permaculture. The detailed, practical approach is used throughout Asia. Livestock management is one part of this system.

Michael DuPonte, Extension Agent and Livestock Specialist with the University of Hawaii, has centrally figured in the state-wide investigation and implementation of the method. His work has been featured in recent issues of *Acres U.S.A.* (see February 2014 issue).

Focus: The absence of odor and flies at the Kang Farm's active swine confinement shelter is seen as due to this cluster of bio-agent and methods: (1) bacterial decomposition agent – litter decay process introduced and maintained by applications of a biological inoculating agent; (2) physical destruction of fly larvae and oxygenation of upper layer of litter – the constant "roto-tillage" of litter surface by pigs' hooves; (3) dry litter surface – morn-

RESOURCES

Information on Michael DuPonte:
www.ctahr.hawaii.edu/hnfas/individualPages/duponte.html
www.ctahr.hawaii.edu/oc/freepubs/pdf/LM-23.pdf

ing and afternoon sunlight exposure; (4) abundant ventilation – passively-directed air flow up and away from litter level by chimney effect induced by shelter's design of roof, open-air walls and N-S oriented siting.

The first and now primary demonstration and education piggery, the farm near Hilo has hosted more than 5,000 visitors during the past four years. Other KNF piggery-education sites on the Islands have hosted another 7,000 visitors. Swine producers and the interested public from the United States and worldwide come to view these piggeries. What are the piggeries' most amazing features that visitors agree on? Happy hogs free of odor and flies.

Comment: That's a remarkable consensus from so many anecdotal observations.

Future: Michael and his office intend that there be ever more happy hogs raised by happy farmers. He welcomes all inquiries. The office expects to formally educate professional advisors on how an ecological pigpen can become a tourist destination.

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NEED MORE INFORMATION?
For more on Cranberry Creek Farm visit *cranberrycreekfarm.com*.
For more on Lazy Lady Farm visit *lazyladyfarm.com*.
For more on Tussock Sedge Farm visit *tussocksedgefarm.com*.

James Silverthorne raised, trained and pastured horses for 35 years at his farm in northeast Pennsylvania. He found best results with homeopathic medical treatment for the animals, mineral amendments to pastures and abatement of manure odor production at animal shelter areas. Before that, he worked with cattle, hogs and goats. Contact him at *js.eco-ag@usa.com*.