



soil aeration • manure removal and burial • increased available fertilization • grazing area • manure runoff control • horn fly and parasite

Mother Nature's Cleanup Crew

Story by

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Dung beetles spend their lives in manure. Adult beetles use liquid contents of manure for nourishment and lay their eggs in balls of manure (brood balls) that they bury; hatching larvae consume most of the brood ball.

Parasitologist Bill Clymer, Amarillo, Texas, has spent his career dealing with livestock parasites. He says dung beetles are some of our best allies for controlling parasites that depend on manure as part of their life cycles. They also remove and bury manure, which helps fertilize the soil and reduce accumulation of manure on top of the ground.

The beetles

"Some species are host-specific. In Australia, there are some that only feed on kangaroo feces. There are tiny beetles that feed on rodent droppings. In Africa, the elephant dung beetle is as large as my fist," Clymer says. "The manure pile from an elephant weighs 80 to 150 pounds. I've seen those piles gone within 24 to 48 hours, being worked on by these large dung beetles."

In the United States, beetles that feed on cattle manure also feed on horse manure. These beetles are not active in colder months, but in warm regions they are active year-round. There are many native species and others that have been imported.

Several types of beetles were imported during the 1970s and 1980s into North America and Australia. These continents did not have extensive livestock populations in early times. Some species followed bison herds in early years, but native species have not been able to keep up with our increased livestock production and manure.

"The native beetles are often a little smaller. Some of the large ones, like the 'rollers' that work on top of the ground, are not native. Several were imported from Africa on a USDA (U.S. Department of Agriculture) program," Clymer says. "Our native dung beetles are good, but not quite as efficient as those from Africa."

Clymer explains that there are three kinds of dung beetles:

Dwellers. Dwellers live in the manure pat itself. They don't tunnel under it, nor do they take the manure somewhere else. Dwellers lay their eggs in manure and help shred the manure. Birds come along and break up the manure pat as they look for beetles.

Rollers. Rollers, or tumblebugs, are larger — about the size of a thumbnail. Not often seen in the northern states, these beetles cut out a little ball of manure, lay an egg in it and roll it away by pushing the ball with their hind legs. They may bury it 200 feet away from its original spot.

Tunnelers. The third type of beetle is a tunneler, which digs below the manure pat. You may not see a change in that pat until you kick it or bump it; then you'll find there's nothing there but the external surface. Sometimes they excavate a place to put manure in the ground, so there may be fresh soil pushed up around the edges or up underneath the shell.

Clymer summarized a science project in which two South Dakota 4-Hers put the worst soil they could find (from a gravel pit) in two plastic tubs — one with dung beetles and one without. Each day for three weeks, the 4-Hers put fresh manure in both tubs.

"The tub with dung beetles kept 'using up' the manure," Clymer says. "But, they had to keep taking out old manure from the other tub."

In the second part of the project, they took the beetles out and planted alfalfa in both tubs.

"In both tubs the alfalfa sprouted, but the plants died in the tub that had never had beetles," Clymer says. "They measured growth of the plants and did soil analysis, and there was a major difference."

Clymer's interest in dung beetles has been focused first on reducing fly populations and internal parasites and, second, on pasture improvement through fertilization and eliminating nongrazed areas.

Horn fly control

Dung beetles are used in Australia to control horn flies, Clymer says, pointing out research showing that beetles bury 95% of the horn flies and 90% of the internal parasites in manure.

One manure pat, without dung beetles, can generate 60-80 adult horn flies. Environmentally, long-term control of pest flies is better achieved by degrading the dung pats where immature flies develop than by sporadically applying toxic chemicals. And, using dung beetles for fly control eliminates problems with resistance to chemical controls such as insecticide ear tags.

Dung beetles are attracted only to fresh manure, which is where horn flies come and where the eggs from internal parasites will be, he explains. A high percentage of horse and cattle parasites are inactivated or destroyed by beetle activity. The tunneling and burying disrupts the parasites' life cycles. Even if the eggs hatch, the young parasites can't reach the ground surface.

"Several years ago I was doing horn fly research in south Texas with ear tags," Clymer said. "A flight of dung beetles moved in, and we had to do the study over again because my control group (those with no insecticide tags) all went to zero."

The dung beetles completely eliminated horn flies in the manure."

A good population of dung beetles can effectively control these flies, he says, because even though the beetles may only be active a few months of the year, it is during the same time the horn flies are active.

Other benefits

The benefits of dung beetles, besides reduction in harmful parasitism, include increased forage availability, reduction of manure runoff during storms or spring thaws, increased water retention in soil, enhanced root penetration by plants, and more nitrogen (N) recycling.

In most pastures, there is tall grass where cattle or horses leave manure piles, Clymer points out. "I used to think grass grew taller there because of nutrients from the manure, but it's because the animals don't want to graze next to their own manure," he says. In fact, the only time they will graze it is when there is nothing else left in the pasture, he adds.

"Not only do you lose the grazing area where horse or cattle manure is sitting, but also an area with about an 18-inch radius around it. Those rough areas continue to expand if you don't have dung beetles," he says. If dung beetles get rid of the piles, this creates more available pasture area the animals will graze.

One pastured animal produces 12 fecal piles per day or 4,300 fecal piles per year. Manure may take 5%-10% of an acre's available grazing area. If no manure is recycled into the soil, one animal can remove 2.5 acres of productive grazing area. A herd of 50 cows can render 129 acres unproductive in one year.

Dung beetles can offset this loss tremendously. An adequate population of beetles can bury 90% of manure on pastures within a week. By contrast, the absence of dung



beetle activity may mean manure will remain on pasture for 16 weeks to a year unless it is mechanically broken up.

“The tunnelers are the most beneficial,” he says. “They bury the manure, aerating soil and fertilizing it. Their activity helps water percolate down into the soil.”

Their actions also help reduce contamination of water sources, Clymer says. Up to 70% of the nitrogen in manure is lost if it isn't buried. If manure is buried, the water runoff won't wash it away into streams.

“A rancher in southern Oklahoma who has 400 mother cows says dung beetles bury a ton of manure a day on his ranch,” Clymer says. “This makes a good, natural fertilizer.”

Dewormers, pesticides may hinder beetles

“The USDA did a study in 1981 and discovered that dung beetles at that time were worth over \$2 billion dollars to our agriculture economy — everything from burying feces to increased grazing areas and putting more nitrogen into the soil, reducing parasitism and improved control of pest flies,” Clymer says. There's increasing interest in dung beetles, and some livestock producers want to make sure they don't disrupt beetle populations with pesticides.

Sometimes our attempts to control parasites may hinder nature's way of dealing with them. Cattle producers who have diligently used certain deworming/delousing products find the manure buildup in their corrals and pastures is more than it was in earlier years.

Some types of dewormers and pesticides destroy dung beetles. “Use of avermectins (Ivomec®, Dectomax®, Eprinex® and generic forms), which are macrocyclic lactones, will eventually decimate dung beetle populations due to lethal activity against the larval stage,” Clymer says. “By contrast, Cydectin® and Quest®, which contain moxidectin, are a little different. They are macrocyclic lactones also, but that family tree splits. You have the avermectins on one side and the milbemycins on the other. Quest and Cydectin are milbemycins, which is moxidectin.”

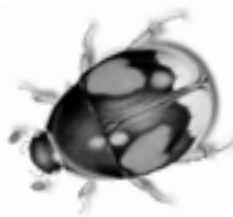
Avermectins do not kill adult beetles, but are 64 times more toxic for immature stages of some species than the milbemycins, he says. If avermectin is used on cattle at label rates to control parasites, no dung beetle offspring will emerge, he explains.

“The manure pat is attractive to beetles when it is fresh — up to about three or four days. Dung beetles will work in it for several days,” Clymer says. “If you use an avermectin dewormer, immature dung beetles may be killed from 10 days to more than six weeks. The time frame for toxicity depends on species of beetle and the specific product used. That means every manure pat that's dropped in that period will be toxic to immature beetles.”

What if you've inadvertently killed off the local dung beetle population? If you stop using the dewormers or

pesticides, dung beetles can move in from surrounding areas. Some species can fly up to 10 miles. They can repopulate the area, but it may take several years.

Also, if you only use an avermectin dewormer once a year, or maybe in the spring and fall, there are several months during summer when beetles can reproduce.



“Even though dung beetles may not completely eradicate manure, when they crawl through it they help mites and bacteria disperse through the pat to help break it down,” parasitologist Bill Clymer says.