

Animal and Poultry Waste Management Center

A candidate technology of the North Carolina Agreements Project:
Development of Environmentally Superior Technologies per
Agreements Between the Attorney General of North Carolina and
Smithfield Foods, Premium Standard Farms and Frontline Farmers

Manure Solids Conversion to Insect Biomass (Black Soldier Fly Project)

This project employs black soldier fly larvae to digest swine manure, thus reducing the amount of manure by half, reducing nutrients, eliminating house fly breeding, reducing odor and producing a value-added product that may be used as an animal feed ingredient.

The use of fly larvae, or maggots, to digest manure has been widely studied; however, the cost of separating the larvae or pupae from manure residues made systems that use fly larvae to treat manure expensive. The researchers involved in this project have developed a simple system to force black soldier fly prepupae to

self-harvest with no external energy requirements, making industrial scale culture on manure practical with this native, non-pest fly. This system can be readily retrofitted to existing swine facilities using the manure handling belt proposed by Gannett Fleming Inc. The black soldier fly-driven system can reduce manure bulk by half, producing a low-nutrient, low-odor, dry residue. This residue is 42 percent protein and 35 percent fat and has been successfully fed to swine, poultry and fish in small trials.

The black soldier fly is a common species in southern states. The flies are slender, about an inch long and are often mistaken for wasps. Like the larvae of many other flies, the larvae of black soldier flies feed on decaying organic matter, including manure, but unlike most insects that decompose feces, the black soldier fly is not considered a pest. And black soldier fly larvae seem to be particularly voracious when it comes to decomposing manure.

The prepupae of the black soldier fly, the stage of the fly's life immediately following the larval stage, is shaped a bit differently than some other fly prepupae. The black soldier fly prepupae is a bit flatter than other flies. That shape appears to play an important role in the self-harvesting system developed for this project.

Manure and fly larvae are put into shallow concrete pits, where the larvae feed on the manure. The edges of the pit are sloped up at a 45 degree angle. When the larvae turn into prepupae, their natural



Dr. Wes Watson and a black soldier fly

Black Soldier Fly Project (continued)

tendency is to move up and away from the larvae. The prepupae are about an inch long. They have no discernible features with the exception of tiny ridges and move by inching along.

The 45 degree angle is steep enough to keep larvae in the pit yet not so steep that prepupae can't crawl out of the pit. Prepupae crawl up the 45 degree slope, fall into a gutter attached to the top of the pit, crawl along the gutter to a pail hung on the gutter, then fall into the pail, where they can be collected. The flatter shape of the soldier fly prepupae appears to help them crawl up the 45 degree slope. The rounder prepupae of other flies tend to roll back down the slope.

It appears likely that this system, which is being evaluated at North Carolina State University's Lake Wheeler Road Field Laboratory in Raleigh, North Carolina, may be used with other systems that separate the solid and liquid portions of the waste stream from swine operations.

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