Dragging Pastures for Fly Control – Maybe

By Matt Steiman, Dickinson College Farm

Many readers have probably been told that dragging pastures can help reduce fly problems on pastured cattle operations. The wisdom goes that since flies breed in manure, breaking up the manure pies will reduce habitat for larvae and result in reduced numbers of adult flies. Many of us have enjoyed watching chickens scratching through cow pies, scattering the manure while eating any grubs they find. Imagine pasture dragging equipment is like a big mechanical chicken that doesn't lay eggs in the woods, tear up your gardens or get eaten by hawks.

At the Dickinson College Farm near Carlisle, PA, we have the pleasure of collaborating with researchers to attempt to answer questions about our farming system using scientific evidence. From 2017 to 2020 we were thrilled to share our pastures with Dr. Jason Smith, a visiting entomologist and biology professor at the College. Dr. Smith and his students directed their brain power at helping to solve fly parasite problems in our herd of 25 pastured Angus and Herford cattle. While our livestock are not certified organic, we lean hard towards all-natural for our customer base, so we've been investigating a variety of methods for non-chemical fly management. After digging through the existing scientific literature, Dr. Smith discovered that the nothing has been published that documents the efficacy of pasture dragging based on field data. So we decided to give it a try with the goal of providing farmers with data-supported recommendations of whether pasture dragging for fly control is worth the trouble in the Mid-Atlantic climate.

Over the 2018 and 2020 grazing seasons we trapped, identified, and counted adult flies emerging from undisturbed and dragged cow pies to see what story the data would tell. First, we built 30 "emergence traps" – these consist of large cones made from 4-foot wide aluminum window screen stapled to a wooden stake. Each trap has a 2" hole at the small (top) end of the cone. We glued a smaller (12") cone, also with a hole at the top, inside the ring of a wide mouth pint mason jar. The small cone sits atop the hole in the larger cone, and the whole trap is spread out over single cow pies and attached to the pasture surface with metal ground staples. A secondary plastic stake salvaged from old electronet fencing goes inside the trap to help keep it all upright. Between the vertical support of the wood and plastic stakes and the tension in the cone base from ground staples, these stood up quite well for two week deployments through a variety of weather. Flies emerging from cow pies or surrounding soil naturally fly or walk up the screen of the trap to the upper cone and are trapped in the jar on top. Most lovers of cattle can appreciate the joy of seeing flies caught in a trap rather than bothering the animals – these traps work well and provided plenty of satisfaction.

For each round of trapping (we did five two-week rounds in 2018 and four rounds in 2020), our student assistants surveyed pasture sections that the cattle had just departed for 30 ideal fresh cow pies and randomly selected equal numbers for the experimental treatment (dragging) or the control (left alone). In 2018 we used a farm-made mechanical drag built from two steel-spring bed frames chained together and weighted down with heavy timbers, pulled behind a gator. Each cow pie was measured before and after dragging to assess the % spread achieved – our bed frame drag was normally quite effective at spreading out the manure into a big smear. In 2020 we used a hand-held plastic rake to more precisely control the extent of spread, and set the experimental treatments as double and triple the original cow pie width. Dragging (or hand smearing) was done within 24 hours of the manure being dropped by the cows. Pies were then left open to the biological community for 5-7 days to allow mother flies to lay

their eggs. Traps were then set and left to catch whatever adult flies emerged over the following two-week period. We then anesthetized the flies and took them to the farm lab (aka shed) for microscope identification to species and counting of flies per trap.

Two main species use fresh manure as breeding ground in much of the US – the horn fly which is about half the size of a house fly and bites the cows on back, sides and belly, and the face fly which looks like a house fly and pesters the cows by lapping up bodily fluids around the eyes and nose. Both can spread disease and reduce cattle feeding time, weight gain and welfare, and both are responsible for substantial economic losses in the US beef industry (the stable fly is a third nasty bugger but it breeds in decaying organic matter, not manure, so was not relevant to this study). Here I must give big praise to our student research assistants C.C. Macperson and Stephanie Levin for the countless hours they spent sorting flies under a microscope – this task requires great patience and attention to detail.

Well, the data are all in and analyzed and… much to our surprise they ***did not prove*** our hypothesis that pasture dragging would reduce fly reproductive success. Of the 8-12 weeks per summer of survey time in 2018 and 2020, in some rounds dragging or hand smearing resulted in reduced fly populations, but in other rounds we actually had more flies in disturbed manure piles. Despite painstaking consideration of the flies per trap against weather, sunlight, and time of year, we were not able to establish a statistically significant correlation that proves the value of our method of manure disturbance for reducing pressure from face and horn flies in pasture. Based on these results alone we cannot recommend pasture dragging for fly control in our region.

Still, there were many valuable lessons learned. First, field entomology research is surprisingly complicated despite a seemingly simple experimental design. There are a great many variables in field conditions that impact the breeding success of wild flies – these include rainfall, temperature, day length, number of adult flies present when a cow pie is laid, position of a cow pie in the sun or shade, and other organisms inhabiting the same manure resource. So, what might work on one farm (or one pasture within a farm) will not necessarily work on another farm, or on the same farm in a different month. Second, in retrospect our dragging technique could have been at fault. Whereas our system resulted in smeared manure that may still have retained some pockets deep enough to allow fly larvae survival, a spring-tooth type drag or other tool that scatters manure into discreet bits might better succeed at drying out manure particles fast enough to limit fly success. Of course, there are other reasons to use a drag, such as distributing manure and breaking up thatch so fly control could be icing on the cake if it's working.

I think the take-home message to cattle producers is, don't assume this (or any) practice is working every time just because it seems like it should. Careful observation can go a long way towards validating your efforts in the field. One helpful thing we learned from Dr. Smith is how to pick through a cow pie to see what's developing inside. Both horn and face flies prefer to lay their eggs in fresh manure. From there the race is on as immature flies develop from larva (maggots) to pupae (sleepy capsule shape) to adults over the course of about 14 days. So you can poke around in manure that's been scattered by your drag and compare it to an undisturbed pie in the same area. Or better yet build yourself a few inexpensive cone traps! Check out our video on youtube by searching for "fly emergence trap installation". I also recommend our fly IPM fact sheet at http://blogs.dickinson.edu/farm/our-livestock at the bottom of the page. Lastly if you have a non-chemical fly management success story to share please contact me at steimanm@dickinson.edu.

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