

## Darkling Beetles and Litter Management

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The impact of field incorporation of turkey litter on darkling beetle survival was evaluated in August over three years 1999, 2000 and 2001. Litter containing all life stages of darkling beetles was collected from a poultry house and loaded into a rear delivery manure spreader. The litter was spread on 280 square feet of field at rates defined by the NC manure management plan. The soil was characterized as Piedmont red clay under drought conditions in 1999, and normal moisture in 2000. In 2001, the litter was applied to sandy soils typical of Eastern North Carolina where most poultry production is found. This report covers only the 2001 results.

Treatments were assigned to the 10 by 40-ft rows and replicated 4 times. Treatments included: control (no incorporation), mulch till (6 inches depth), disk (3 inches), and moldboard plow (12 inches). Litter in mulch, and disk treatments were incorporated with 2 passes of the implement and moldboard plow treatment with one pass.

Sampling devices to include pit fall traps, emergence traps, and tile refugia. These traps provided the most efficacious method for determining beetle survival. Traps were examined for beetles on day 1, 7, 10, 14, 21, 25 and 28 following incorporation. Sticky cylinder traps were placed around the perimeter of the field site to monitor migration from the field.

Incorporating poultry litter into the soil reduced darkling beetle survival, regardless of the method of incorporation. Mean beetle collection on the control plots, i.e. no incorporation was  $3.36 \pm 0.2$  over the 28-day period. Beetle survival was significantly greater in the unincorporated row than on incorporated rows in 1999, (ANOVA,  $F = 14.66$ ,  $df = 4652$ ,  $P \leq 0.0001$ ). Mean beetle collections for disk

treatment was  $1.73 \pm 0.1$ , mulch till  $2.62 \pm 0.2$  and plow  $1.28 \pm 0.1$ . Unlike Piedmont clay, there were significant differences between disk, mulch till and plow treatments on sandy soils (Figure 1). Plow was the most effective method of incorporation followed by disk, and mulch. In sandy soils mulch reduced beetle survival, however this difference was not significant from the control ( $F = 2.16$ ,  $df = 2304$ ,  $P \leq 0.142$ ).

In this experiment litter containing approximately 88,000 darkling beetles was applied to a field. The number of trapped darkling beetles emerging from incorporated litter decreases from day 1 through day 7 and then increased on day 10 and 17 (Figure 2). Similar increases in beetle emergence occurred in other studies approximately 14-17 days following land application of litter. Some beetles survive incorporation of litter, probably in immature stages, and emerge from the soil as adult beetles about two weeks after litter application.

Darkling beetle migration. Our objective is to determine if darkling beetle adults are able to relocate from fields to houses.

Approximately 88,000 beetles were applied to this field prior to incorporation of the litter. The parameter of the field was surrounded with Cylinder type alsynite traps covered with sticky acetate sheets to capture any flying insects from the application site. Sticky traps were arranged by replicate and ranged in order from nearest, replicate 1 to farthest, replicate 4. Beetles captured on the sheets were counted and removed during the sampling period.

The nearest poultry house was approximately 40 meters from the corner of the field site nearest to replicate 1. Seven days after the litter was applied to the field darkling beetles began to fly and were captured by the sticky traps (Figure 3). The mean number of beetles from replicate one,  $6.3 \pm 1.1$ , rep. two,  $5.5 \pm 1.15$ , rep. three  $6.03 \pm 1.37$  and rep. four  $3.04 \pm 0.59$ . Although half as many beetles were caught from sticky traps farthest from the poultry house, these differences were not significant ( $F = 2.17$ ,  $df = 342$ ,  $P < 0.09$ ).

Pest management is a biosecurity priority for the poultry industry. Reducing populations of darkling beetles reduces risk of disease outbreak. Spreading litter in the cool seasons followed by disking will reduce beetle emergence and dispersal potential.

Mean Beetle Emergence from Sandy Soil Post Incorporation

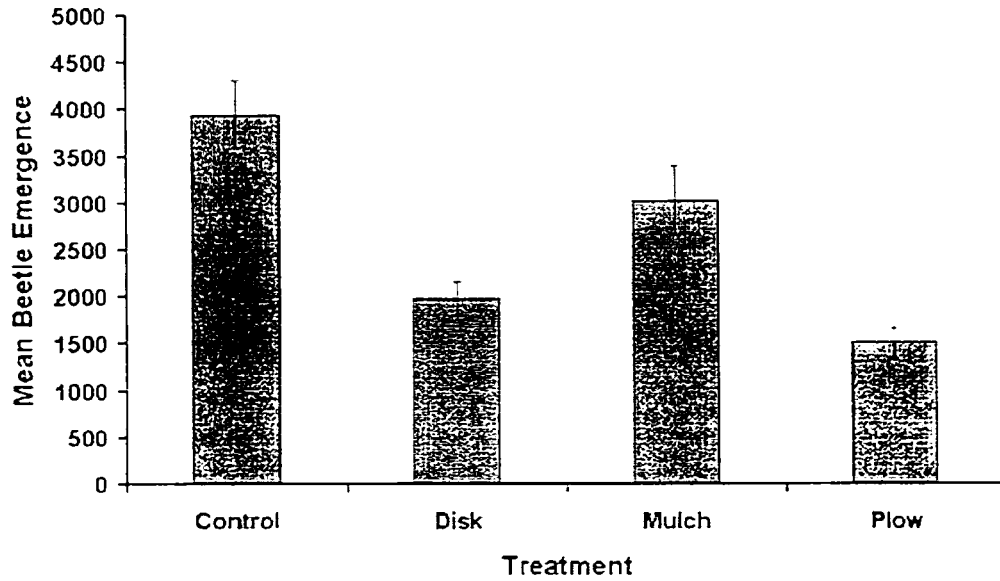


Figure 1. Mean number of beetles surviving incorporation of poultry litter in sandy soils during a 28-day period.

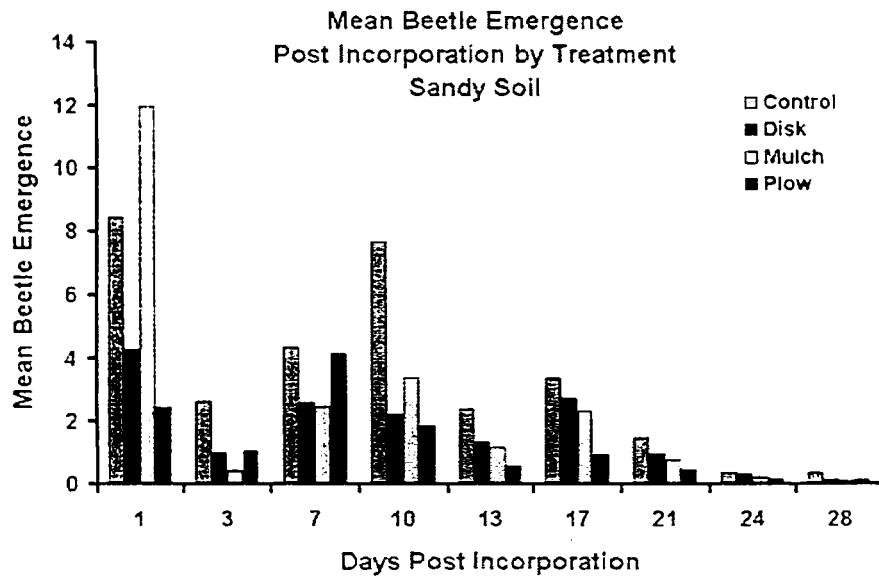


Figure 2. Mean number of beetles emerging from sandy field soils following mechanical incorporation of litter with moldboard plow, disk, mulch till and control.

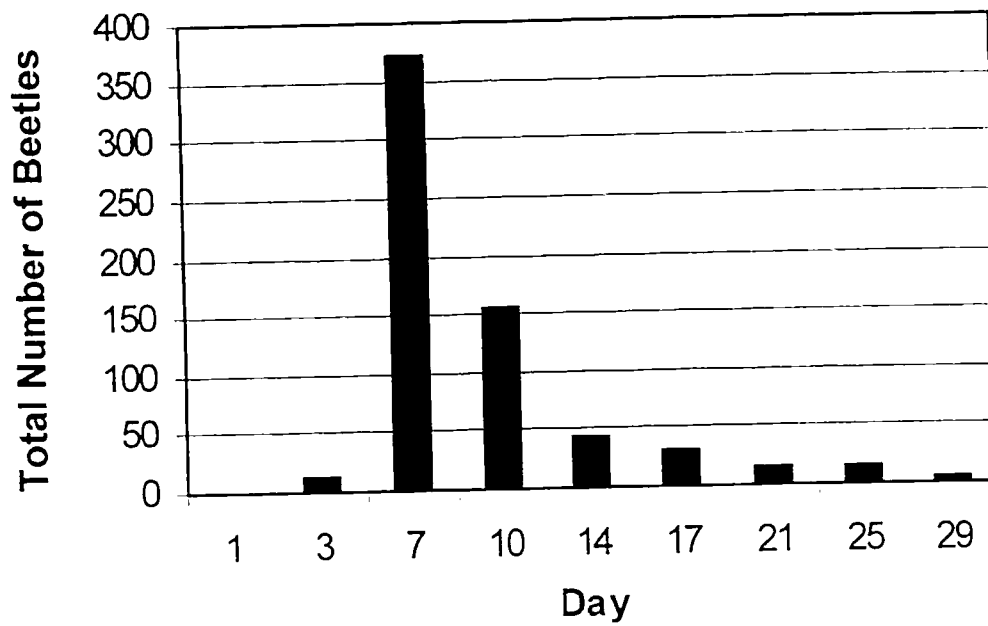


Figure 3. Total of number beetles collected from sticky traps within 40 meters of a poultry house following the application of poultry litter to field soils.