COMPARISON BETWEEN DROP CLOTH AND SUCTION SAMPLING IN COTTON DURING 1998

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Abstract

A study was conducted in 1998 to determine the relative efficiencies of drop cloth and suction sampling methods in cotton. Sample data were recorded for ten arthropod taxa including tarnished plant bugs, big-eyed bugs, lady beetles, minute pirate bugs, nabids, lacewings, spiders, beet armyworms, and tobacco budworms and cotton bollworms (grouped as heliothines). The data indicated the drop cloth caught more insects per meter row than did suction sampling for four of the populations (lady beetles, minute pirate bugs, spiders and heliothines) as well as for total predators. No significant differences between the drop cloth and suction sampling methods were found for the other taxa sampled, but generally low numbers of these insects were present.

Introduction

Insect damage to cotton crops is an obvious concern to growers. In order to combat and prevent this damage, the efficiency of arthropod-sampling techniques should be tested and improved if at all possible. One such commonly practiced method utilizes the drop cloth. This sampling method has proven to be efficient for at least some pests and beneficial arthropods, yet can be time consuming, thereby limiting the possible area sampled. Another such sampling method utilizes a suction sampling device that could possibly reduce the time needed to sample equivalent areas. Other studies have utilized the suction technique in various crops. Costello and Daane (1997) conducted a direct comparison of these two methods for spiders in grape vineyards ,and found the drop cloth to be the most accurate method for estimating species composition. De Barro (1991) also studied the possible uses of the suction sampling method for aphid populations in bermuda grass, and found it to be an accurate and efficient method. The purpose of this study was to determine the relationship between drop cloth and suction sampling for various pest and beneficial arthropods in cotton.

Materials and Methods

This field study was conducted at Ramsey bottom on the North Farm of the Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, MS, during 1998. The cotton variety used for this study was Stoneville 474, planted 4 May in 38-inch rows at typical plant densities (10 plants per meter). For another purpose, a test was designed with six treatments, each replicated four times in a randomized complete block. Treatments were different levels of insecticide, fertilizer and Pix (mepiquat chloride). Each of the twenty-four test plots were 16 rows wide by 50 feet in length.

The drop cloths used for sampling were 1m x 1 m. Two meters of row were sampled from the approximate center of each plot two times a week from June 10 to August 21, and arthropods were counted in the field. The suction sample device consisted of a high velocity (165 mph) BV1650 Weedeater blower/vacuum. The unit is powered by a 22 cc, two stroke, gas powered engine. The diameter of the suction tube was 12 cm. The captured bags were constructed of 16-mesh nylon, and were held in place by heavy-duty rubber bands. After the suction samples were collected, the bags were transported in a cooler to the lab for counting of arthropods. These samples were also collected two times a week from June 10 to August 21.

The arthropod populations counted included tarnished plant bugs, big-eyed bugs, lady beetles (Coccinellidae species), insidious flower bugs, damsel bugs, green lacewings, spiders, beet armyworms and heliothines (tobacco budworms and cotton bollworms).

Seasonal mean numbers in drop cloth and suction samples were determined for each arthropod population, total predator population, and the total hemipteran predator population. The ratio of seasonal mean numbers of insects to the standard error of these means was used as an index of precision for each sampling type (Tables 2 and 3). Data were analyzed by analysis of variance procedures using the combined data from all six treatments (Proc GLM, SAS Institute 1988), using Fischer's LSD for mean separation ($P < 0.05$).

The data were also analyzed by regression analysis (Proc REG, SAS Institute 1988) to determine the correlation between drop and suction samples. Overall means across all treatments, for each arthropod group, were calculated for every sample date for the drop cloth and suction samples. For regression, we only used data where both drop cloth and suction samples were taken on the same dates. These mean values were regressed on each other using a simple linear model.

Results and Discussion

On a per meter row basis, the mean seasonal average number of arthropods on the drop cloth was significantly greater ($P < 0.05$) than in suction samples for four of the studied taxa (big eyed bugs lady beetles, spiders, and heliothines and for the total predator population). There were no significant differences between drop cloth and suction samples in the mean number of arthropods collected

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for the other six arthropod taxa, including total hemipteran predators. However, the precision of the drop cloth and suction samples were similar (Tables 2 and 3).

For three of the four taxa where seasonal differences were found between mean numbers of arthropods caught in drop cloth verses suction samples, there were also significant correlations between the two sampling methods (Table 1). There was also a significant corellation between drop cloth and suction samples for insidious flower bugs and the total predator population. Slopes from the regression analyses indicate which sampling method caught the most insects because intercept values were not significantly different from zero. These slopes show that the suction method collected 81% as many total predators, 85% as many lady beetles, 38% as many minute pirate bugs, 48% as many spiders, and 73% as many heliothines as did the drop cloth on a per meter basis. Poor regression analysis between drop cloth and suction samples for tarnished plant bugs, ants, damsel bugs, green lacewings and beet armyworms was likely due, at least in part, to the low numbers of insects collected.

Summary

These results represent a component of a larger research project initiated in 1998. Drop cloth samples tended to catch more arthropods than suction samples. The relatively high correlation between drop cloth and suction samples for several taxa indicates that these sampling techniques would be similarly useful in quantifying these populations. These data do not fully represent sampling efficiency. Differences in effort for drop cloth and suction samples also influence comparative efficiency. This factor will also be evaluated.

References

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Table 1. Regression coefficients and probability levels for simple linear regressions of selected arthropod taxa collected in drop cloth samples verses suction samples.

Population	R^2	Prob > F
Total Predators	0.81	0.001
Lady Beetles	0.87	0.0001
Insid. F. B.	0.76	0.001
Spiders	0.40	0.05
Heliothines	0.67	0.01

Table 2. Seasonal mean numbers (SE) and ratio of mean to standard error for taxa sampled with drop cloth.

Population	Mean (SE)	Ratio(Mean/SE)
Total Pred.	3.41 (.30)	11.31
Lady Beetles	1.81 (.24)	7.44
Insid. F. B.	0.02 (.01)	2.01
Spiders	1.07 (.08)	13.67
Heliothines	0.56 (.08)	7.59
Tar. Plant Bugs	0.02 (.01)	2.01
Hemip. Pred.	0.29 (.04)	7.73
Big Eyed Bugs	0.24 (.03)	7.50
Nabids	0.04 (.01)	3.05
Lacewings	0.11 (.03)	4.06
Ants	0.13 (.03)	4.22
Beet army.	0.03 (.02)	1.18

Table 3. Seasonal mean numbers (SE) and ratio of mean to standard error for taxa sampled with suction device.

Population	Mean (SE)	Ratio(Mean/SE)
Total Pred.	2.65 (.25)	10.42
Lady Beetles	1.61 (.21)	7.83
Insid. F. B.	0.01 (.01)	1.42
Spiders	0.63 (.06)	10.68
Heliothines	0.53 (.07)	7.86
Tar. Plant Bugs	0.03 (.01)	0.035
Hemip. Pred.	0.24 (.04)	6.47
Big Eyed Bugs	0.18 (.03)	5.77
Nabids	0.05 (.02)	3.05
Lacewings	0.10 (.02)	4.38
Ants	0.06 (.02)	2.56
Beet army.	0.00 (0.00)	0.00