IMPACTS OF HABITAT TYPES ON BOLL WEEVIL PHEROMONE TRAP CAPTURES

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Abstract

During preliminary studies to examine the potential for suppression of overwintering boll weevil populations by mass trapping, we took the opportunity to examine the effects of surrounding habitat on trap capture. A trapping system composed of 750 pheromone traps was arranged within a contiguous block of approximately 4,000 acres. Habitat types within this block varied from fallow land and improved pasture to maturing sugarcane and wooded resaca (oxbow lake). Habitat type influenced trap capture but the magnitude of these effects varied with the time of year. In general, traps placed adjacent to prominent vegetational features (wooded resaca, brushy canal banks, growing sugarcane) tended to capture more weevils than did traps in more sparsely vegetated surroundings (fallow land, pasture, or barren canal banks). These results suggest that the cost of conducting a mass trapping effort can be reduced by reducing the number of traps associated with habitats where weevil captures are typically very low. These results may also be useful in manipulating trap placement to improve detection capabilities of traps in other boll weevil management programs.

Introduction

The boll weevil in the Lower Rio Grande Valley of Texas remains active and responsive to pheromone traps throughout the year when temperatures permit (Guerra and Garcia 1982, Wolfenbarger *et al.* 1976), and few weevils are found in the habitats typical for overwintering populations of other areas (Graham *et al.* 1978). The high level of activity during the non-cotton season may present unique opportunities for management or suppression of weevil populations. In the fall of 1996, we initiated a preliminary experiment to determine the numbers of weevils that could be removed from a delineated area using standard pheromone traps during the non-cotton season. Our study site was chosen using criteria that included the need for a single, contiguous area of relatively large acreage, representative of the normal cropping pattern of the area, and under the direction of a single grower. The study area ultimately selected also contained several perennial vegetational or landscape features common to many cotton production areas of the Valley. Because mass trapping efforts are expensive, especially with regards to the labor required for servicing the traps, avoiding the trapping of areas with low or no weevil captures may reduce the costs of such efforts. The objective of the research reported herein was to examine the effects of trap surroundings on associated weevil captures, and thereby assess the potential to reduce trapping costs by omitting trapping efforts from habitats where weevil captures are typically low.

Materials and Methods

The study was conducted from 14 October 1996, to 5 May 1997, on the Russell Plantation south of San Benito, TX. The Plantation is composed of about 4,000 contiguous acres including improved and unimproved pasture, areas of wooded thicket and wooded resaca (oxbow lake), both brush-lined and barren irrigation and drainage canals, and row crops including corn, sorghum, cotton, and sugarcane. In mid-October, a system of 750 standard Hercon Scout traps (Hercon Environmental, Emigsville, PA) was installed on the Plantation. Traps were placed at about 265-ft intervals along all passable farm roads, turnrows, fencelines, and canal and resaca banks. A "primary habitat" (e.g., resaca, fallow, sugarcane) was designated for each trap based on the immediate trap surroundings. In designating this habitat, only the visually dominant vegetational or physical feature associated with the trap was considered. For example, the primary habitat assigned a trap placed on the edge of a fallow field bordered by standing sugarcane would be "sugarcane". Traps were serviced weekly and pheromone lures were replaced on alternate weeks except when the area became impassable because of heavy rains. Captured weevils were placed in vials of alcohol and returned to the laboratory where they were sexed and counted.

Seven habitats were selected for analysis (Figs. 1-4). Habitats represented by less than 30 traps or which were located entirely within a single spatially limited location on the Plantation were excluded. Selected habitats were sugarcane (37 traps), resaca (104 traps), canal with brush-covered banks (238 traps), brush (41 traps), fallow (118 traps), canal with barren banks (32 traps), and pasture (161 traps). Sugarcane was 6 to 8 ft tall at the time trapping began, and was harvested and had substantially regrown by the time trapping was terminated. Resaca was characterized by densely wooded banks extending approximately 30 to 50 ft from the water's edge. Canals characterized as brushy had banks populated by mesquite and other woody plants. Characterization as brushy was subjective and based on density and height of the vegetation. Canal banks without vegetation or with sparsely distributed trees or only low growing shrubs were not considered as brushy. Areas designated as brush were densely wooded with various species of native trees and woody shrubs. The designation of fallow indicated the locations of row crops of the previous production season, including cotton. Although these areas were tilled prior to the initiation of trapping, many of these areas were weedy during at least a part of the

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trapping period. In addition, presence of regrowth or volunteer cotton became apparent in some former cotton fields until these fields were plowed again in November. The category of pasture included both improved and unimproved pastures. Improved pastures were characterized by the scarcity of mesquite and other low-growing shrubs while unimproved pasture was sparsely populated by these types of plants. The two types of pasture were not distinguished because of the difficulty in devising consistent criteria for their separation, and because the shrubbery in the unimproved pasture was neither dense enough nor spatially distributed so as to provide a clear distinction between brushy and cleared areas.

Weekly trap captures were analyzed by analysis of variance using the SAS procedure PROC GLM (SAS Institute 1988) after the data were separated into three sets designated as fall, winter, and spring. Although this separation was somewhat arbitrary the different periods were characterized by distinctly different levels of trap capture. The time periods were also separated by periods during which substantial portions of the data were missing because inclement weather limited access to the traps. The anova models included main effects of habitat, week, and weevil sex, and also their interaction terms. Means of main effects were separated using the REGWQ option of PROC GLM (SAS Institute 1988).

Results

Data from the fall trapping period indicated that trap captures varied among trapping weeks (F=103.89; df=8, 12582; p<0.01) and were influenced by surrounding habitat (F=303.08; df=6, 12582; p<0.01) (Fig. 5). Mean trap captures for both weevil sexes were similar (F=0.31; df=1, 12582; p=0.58). Also, interaction terms indicated that trap captures of both sexes were similarly affected by week of the trapping period (sex by week, F=1.02; df=8, 12582; p=0.42) and trap surroundings (sex by habitat, F=0.85; df=6, 12582; p=0.54). Mean trap capture was highest around the resacas (7.1 weevils trap^{-1} week^{-1}). Trap captures around sugarcane (5.8 weevils trap^{-1} week^{-1}) were higher than around brushy canals (4.5 weevils trap^{-1} week^{-1}), which were higher than around barren canals (2.7 weevils trap^{-1} week^{-1}) or brush (2.6 weevils trap^{-1} week^{-1}). Captures were lowest around fallow fields (1.7 weevils trap^{-1} week^{-1}) or pasture (1.3 weevils trap^{-1} week^{-1}). However, the week by habitat interaction (F=23.53; df=48, 12582; p<0.01) indicated that effects of trap surroundings were not consistent among weeks (Fig. 5). Although the data indicated that highest trap captures tended to occur in traps associated with prominent vegetation, captures by traps associated with brush did not exhibit this trend early in the trapping period. This may have been a result of the limited distribution of this habitat. Also, in late October and early November captures along the barren canals were not representative of the overall capture trends. This observation may be explained by the presence of regrowth or volunteer cotton in fallow fields. These areas were primarily bordered by barren canals. This cotton was removed in November at about the time that trap captures along the barren canals diminished.

Trap captures were lower during the winter trapping period, but again varied among weeks (F=119.49; df=9, 14226; p<0.01) and trap surroundings (F=239.55; df=6, 14226; p<0.01). Captures of the two sexes were again equivalent both overall (F=2.24; df=1, 14226; p=0.13) and in relation to week of the trapping period (week by sex interaction, F=1.52; df=9, 14226; p=0.13) and habitat (habitat by sex interaction, F=1.00; df=6, 14226; p=0.43). As in the fall, trap captures were highest in traps associated with prominent vegetation (Fig. 6). Mean capture for the period was highest for brush (1.2 weevils trap^{-1} week^{-1}). Captures around the resaca (1.0 weevils trap^{-1} week^{-1}) were higher than those around sugarcane (0.5 weevils trap^{-1} week^{-1}), which were higher than those around brushy canals (0.4 weevils trap^{-1} week^{-1}). Captures were lowest around pasture (0.1 weevils trap^{-1} week^{-1}), barren canals (0.1 weevils trap^{-1} week^{-1}), and fallow fields (0.1 weevils trap^{-1} week^{-1}). The week by habitat interaction (F=19.00; df=54, 14226; p<0.01) also indicated variation in the effects of trap surroundings over time. This interaction may have been caused by two periods (week of 6 January, weeks of 10 and 17 February) during which little difference occurred in trap captures among habitats because of the low numbers of weevils captured.

Inclement weather interfered with trap servicing during the spring period. Thus, only two weeks of uninterrupted data collection occurred. Results were similar to those of the other trapping periods with respect to the influence of both week of trapping (F=78.93; df=1, 2710; p<0.01) and habitat (F=45.63; df=6, 2710; p<0.01) on trap captures, but deviated from other trapping periods in that captures differed between the sexes (F=10.79; df=1, 2710; p<0.01). Although trap captures of females (1.1 weevils trap^{-1} week^{-1}) were greater than captures of males (0.9 weevils trap^{-1} week^{-1}), the differences were not substantial. Also, no interactions between weevil sex and week of trapping (F=1.91; df=1, 2710; p=0.17), or between sex and habitat (F=1.27; df=6, 2710; p=0.27) were detected. Trap captures were highest near brush (2.6 weevils trap^{-1} week^{-1}) and sugarcane (2.5 weevils trap^{-1} week^{-1}), and lowest around fallow fields (0.3 weevils trap^{-1} week^{-1}) and barren canals (0.3 weevils trap^{-1} week^{-1}). Captures around the resaca (1.2 weevils trap^{-1} week^{-1}), brushy canals (0.8 weevils trap^{-1} week^{-1}), and pastures (0.8 weevils trap^{-1} week^{-1}) were intermediate. Effects of habitat on trap capture varied between weeks (week by habitat interaction, F=12.12; df=6, 2710; p>0.01) (Fig. 7). Elevation of the status of pasture from the group of lowest trap captures to an intermediate position seems to have occurred on the basis of one week of relatively high captures. Overall, the association of higher trap captures with habitats having prominent vegetational features was again apparent.

Discussion

Although some variation exists in our data, the results consistently indicate that placement of traps in association with prominent vegetational features tends to increase boll weevil capture rates compared with placement of traps in more sparsely vegetated surroundings. This general trend was apparent for all trapping periods. As a rule, barren canals, fallow fields, and pastures were areas in which few weevils were captured. Exceptions to this trend occurred for the barren canals during and immediately after the time when regrowth and volunteer cotton was present in adjacent fields. A further exception regarding the pasture occurred during the last week of the study. This exception may have been related to spring weather conditions and cropping patterns. Cotton planting in much of the Lower Rio Grande Valley was delayed in the spring of 1997 because of unusually high rainfall in March and early April so by the last week of the study cotton fields on the Plantation were not yet producing squares. However, the generally lush condition of vegetation present in trapping habitats including the unimproved pasture, and the increasing size and apparency of sorghum and corn plants in Plantation fields may have diminished effects of habitat on weevil response to traps during the last weeks of trapping. Our data also suggest that costs of mass trapping efforts may be reduced by omitting traps from sparsely vegetated sites within the trapping arena. Omission of these traps may not necessarily result in a reduction in total weevil captures because the relatively few weevils present in these areas may be subsequently captured by traps in more attractive surroundings.

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Acknowledgments

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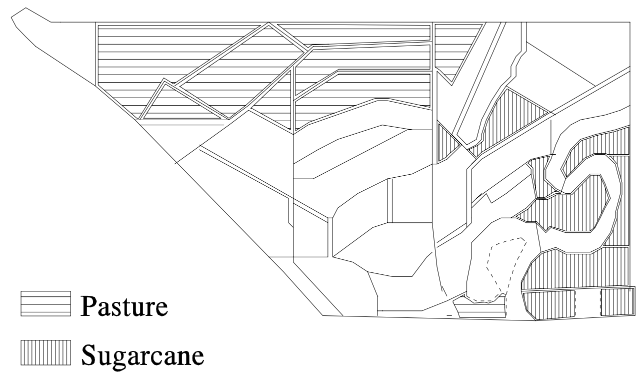

Figure 1. Locations of pasture and sugarcane habitats in Russell Plantation boll weevil trapping experiment.

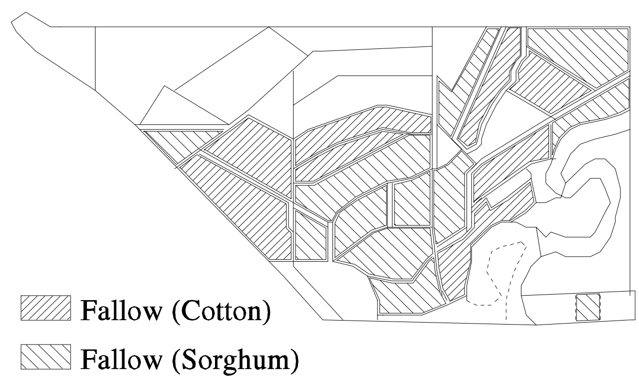

Figure 2. Locations of fallow field habitats in Russell Plantation boll weevil trapping experiment.

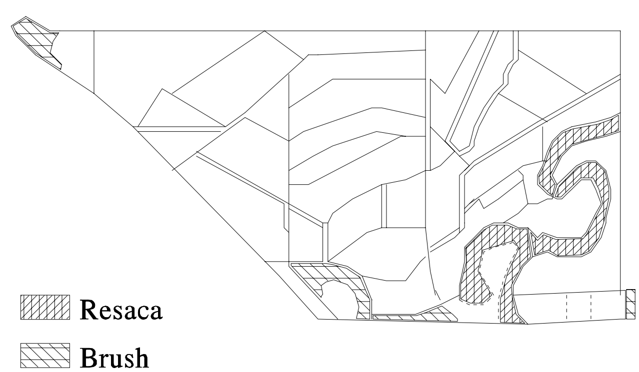

Figure 3. Locations of resaca and brush habitats in Russell Plantation boll weevil trapping experiment.

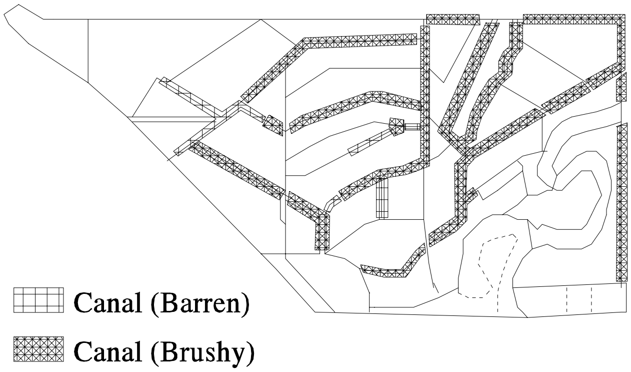

Figure 4. Locations of barren canal and brushy canal habitats in Russell Plantation boll weevil trapping experiment.

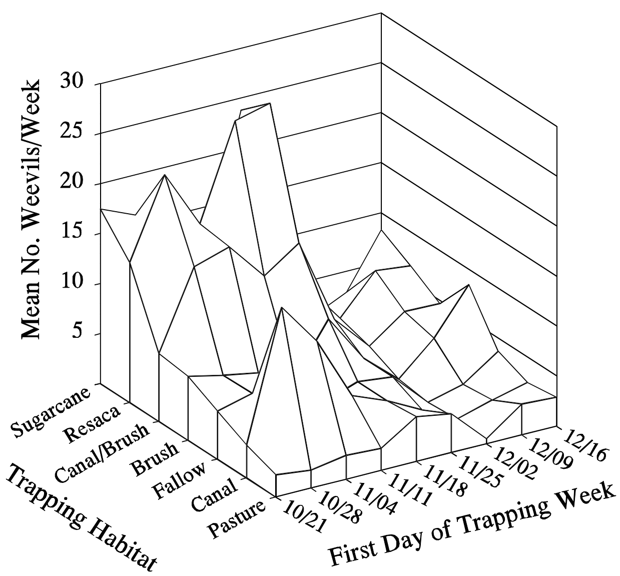

Figure 5. Mean weekly boll weevil trap captures associated with habitat types on Russell Plantation during the fall trapping period.

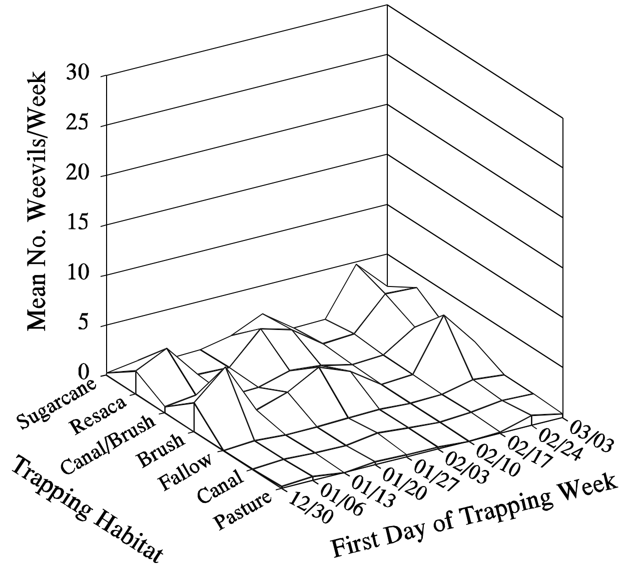

Figure 6. Mean weekly boll weevil trap captures associated with habitat types on Russell Plantation during the winter trapping period.

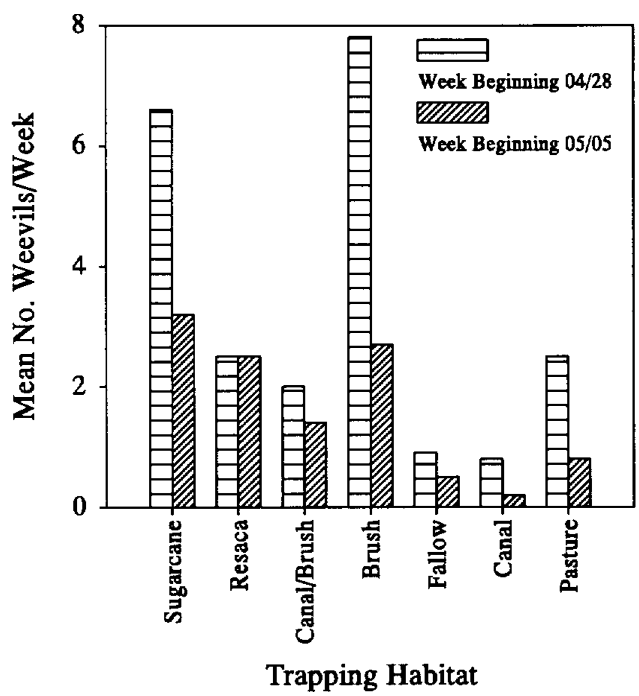

Figure 7. Mean weekly boll weevil trap captures associated with habitat types on Russell Plantation during the spring trapping period.