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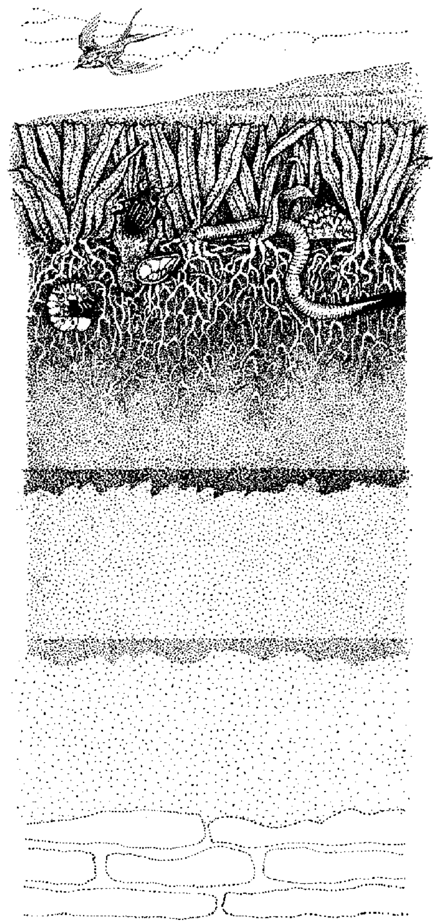

Ecological Aspects of Crabgrass Infestation in Cool-Season Turf

Crabgrass *(Digitaria spp.)*, a seed propagated summer annual grass species, is considered one of the most important weeds in turf management systems. Many studies have been focused on herbicide control, however, research on the biology and ecology of crabgrass is conspicuously absent, especially information on the ecological aspects influencing the infestation in turf. Understanding these factors could lead to improved crabgrass management strategies.

The purpose of this study was to determine the effects of open space (gap size), thatch layer and soil temperature on crabgrass infestation in turf. ■

Materials and Methods

Field experiments were conducted in 1996 on a mature stand of turf-type tall fescue *(Festuca arundinacea)*. Experiment A was on a site with a history of heavy smooth crabgrass infestation, and Experiment B was on a site without a history of infestation.

Four different sized gaps of 2.5 to 20.0 cm diameter were created on April 15 by spot treatment with 2.0% (v/v) Finale (glufosinate); and the closed gap (0.0 cm gap) was 10 x 10 cm area. After turf died in Experiment B, half the gaps were disturbed by removing dead grass and thatch and replacing the area with soil. Three grass weed species, smooth crabgrass *(D. ischaemum)*, large crabgrass *(D. sanguinalis)* and goosegrass *(Eleusine indica)* were overseeded on May 22 in each gap. All plots were arranged in randomized complete block design with 5 replications and mowed biweekly at 2.5 inch height with the clippings removed. Each gap size was maintained by clipping the encroaching leaf blades once a week.

Seedling emergence rate and tiller development were recorded weekly from May 1 to August 23. Seedheads of each species were counted weekly in August. Soil temperatures at 2.5 and 5.0 cm depth were continuously monitored from May 24 to July 19 at 30 minute intervals with in-ground thermocouples and a CR10X Measurement and Control Module (Campbell Scientific, Logan UT).

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This Times

Crabgrass

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Results and Discussion

Experiment A: site with natural smooth crabgrass population.

Smooth crabgrass seedling emergence occurred on May 24 regardless of gap sizes, however, significantly more seedlings emerged in the gaps compared to the closed gap (Figure 1).

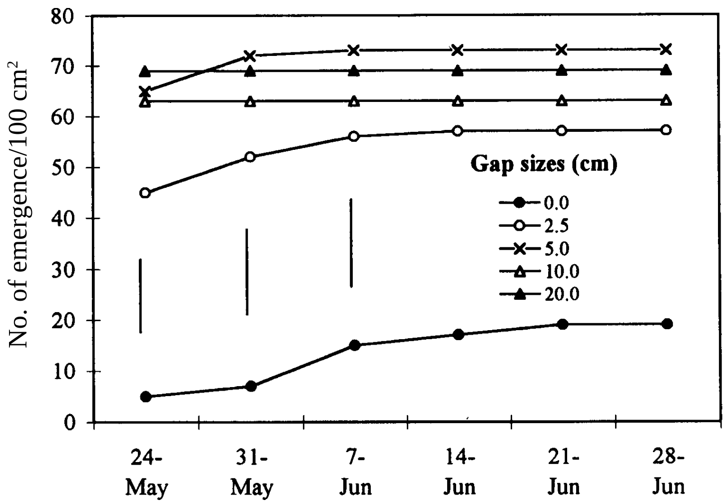

Figure 1. Cumulative seedling emergence of smooth crabgrass in the gaps of cool-season turf. Vertical bars represent LSD at P=.05 for comparison of the means on each date.

There was no significant difference in the number of emerged seedlings between 2.5 and 20.0 cm gap. Seedlings emerged over the period of 4 weeks in closed gap, but among the gaps, seedling emergence was completed in a week. All emerged seedlings in the gaps survived to seedhead production. Therefore, tall fescue turf with a history of smooth crabgrass infestation does not require open space for further infestation.

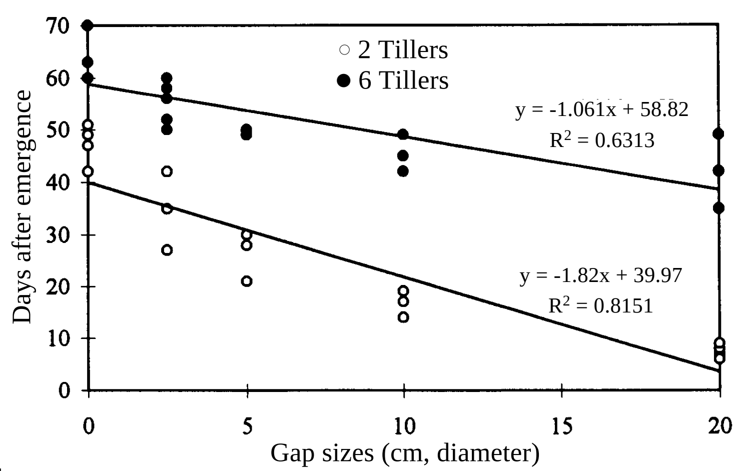

Figure 2. The days after emergence to 2 and 6 tillers of smooth crabgrass seedling in different gap sizes of cool-season turf.

Tiller development was highly correlated with the gap sizes, with more rapid tillering rate in the larger gaps. As a measure of this, timing interval from seedling emergence to 2 tillers was 40 days in closed gap compared to 10 days in the largest gap (Figure 2). This suggests that the timing of postemergent herbicide treatments should be more critical in an open turf than a dense turf area because the emerged seedlings more rapidly achieve a size that is difficult to control.

The daily mean temperatures in 0 to 20.0 cm gap were not substantially different from each other, however, the daily temperature fluctuations were significantly different with the largest gap recording the lowest and highest in a day. (Figures 3 and 4). These results suggest that temperature differential could be more important than mean temperature when predicting the emergence and development of crabgrass in turf. Additionally, current modeling approaches using mean temperature without considering the effect of daily temperature fluctuation could lead to important errors in predicting the behaviors of weeds under different environmental conditions.

Experiment B: site without weed infestation.

Thatch layer significantly affected the seedling emergence and development of smooth and large crabgrass and goosegrass. Gaps with thatch had less seedlings emerge compared to gaps without thatch (Figure 5). Seedling emergence of smooth and large crabgrass among the gaps were similar to the result in Experiment A (i.e. less seedlings emerged in closed gap). Interestingly, goosegrass seeds failed to emerge in closed gap. Seedhead production of smooth and large crabgrass was not significantly influenced by gap sizes, still less goosegrass seedheads were produced compared to crabgrass. These results suggest that dense turf could exclude seed-propagated weed species, and also reduce the amount of the seeds in turf in subsequent years.

Conclusions

These data confirm the paradigm that dense turf will exclude seed-propagated weeds. However, it also illustrates that weed species differ in the minimum turf density required to prevent weed infestations.

Current models based on daily mean temperature may not be valid for predicting seedling emergence of smooth crabgrass in turf.

The prevention of weed seed germination and inhibition of seedling growth and development are active components of this competitive relationship.

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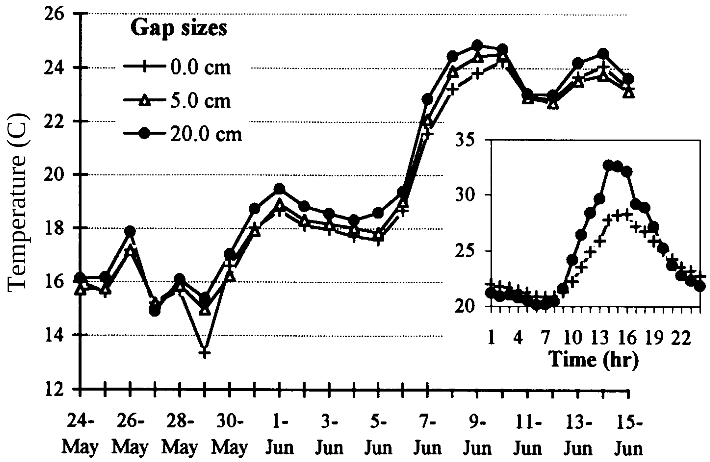

Figure 3. Daily mean temperature at 2.5 cm soil depth of different sized gaps in cool-season turf. The inset shows hourly temperature during June 9 under both gaps.

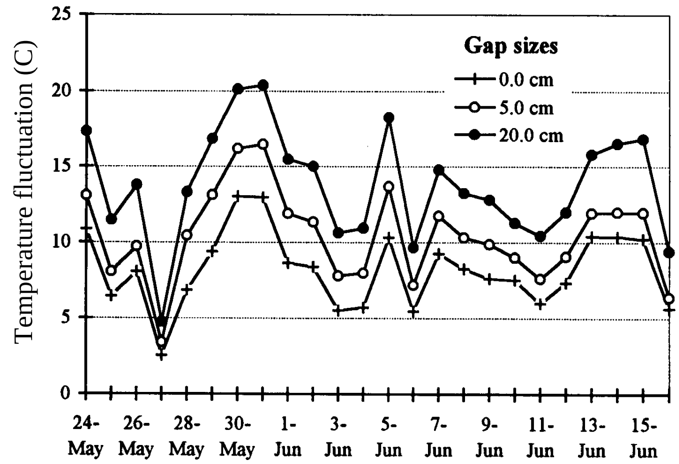

Figure 4. Daily temperature ***differential*** *at 2.5 cm soil depth of different sized gaps. Smooth crabgrass emergence observed on May 24.*

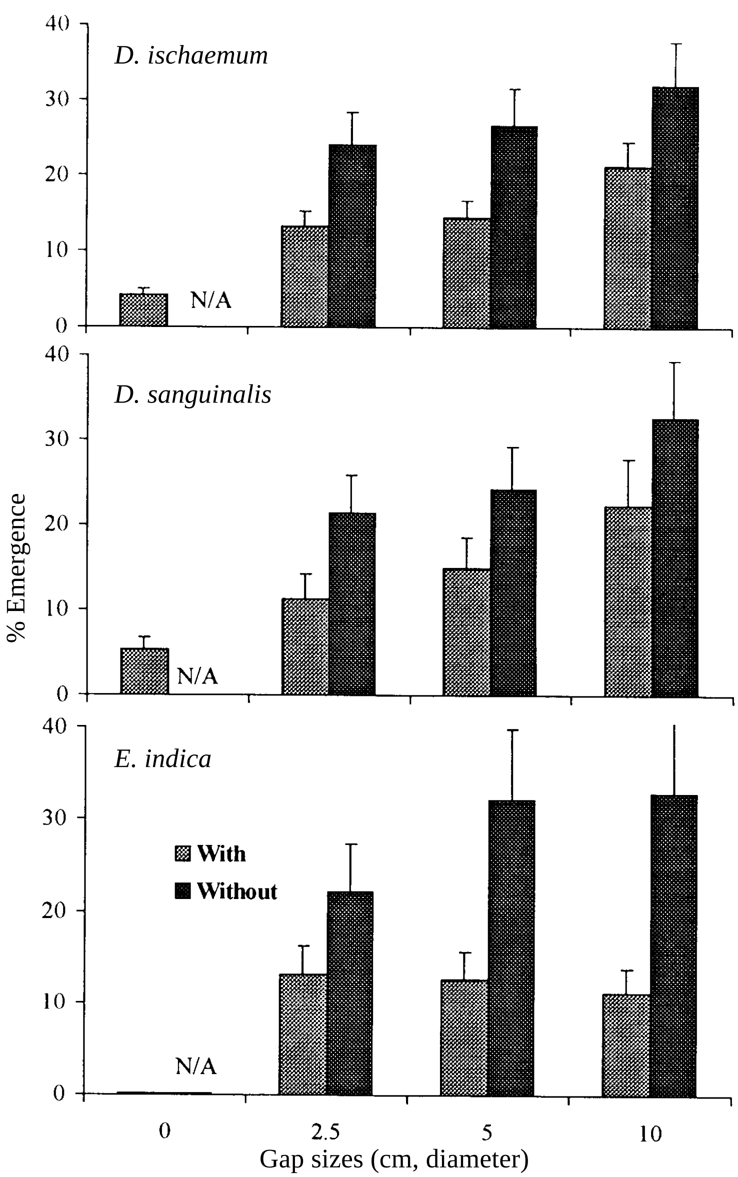

Figure 5. Seedling emergence of each species in different sized gaps with and without thatch of tall fescue turf. Vertical bars represent SE of the means.

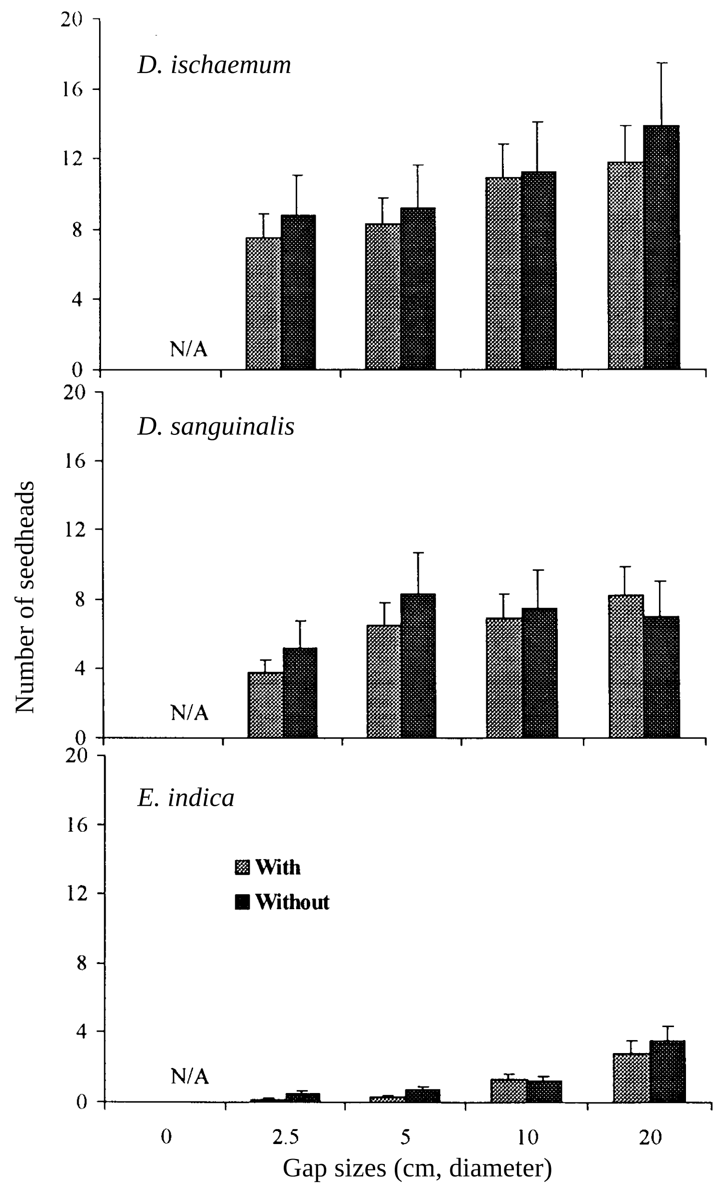

Figure 6. Seedhead production of each species in Site B (no history of infestation) in different sized gaps with and without thatch of tall fescue turf. Vertical bars represent SE of the means.