

Reduced Pesticide Transport in Runoff with Hollow Tine Core Cultivation

The quantity of pesticides transported with runoff from solid tine plots exceeded that of the hollow tine plots. Plots receiving hollow tine core cultivation to manage thatch 63 d prior to runoff showed a 17, 15, 24 and 23% reduction in cumulative dicamba, flutolanil, MCPP and 2,4-D loads, respectively. Cumulative loads of chlorpyrifos were similar. Following the second core cultivation (2 d), hollow tine plots displayed an even greater reduction in cumulative pesticide loads relative to the solid tine plots with 46, 55, 37, 35 and 57% decline in cumulative loads of dicamba, flutolanil, MCPP, 2,4-D and chlorpyrifos (Figure 5). Correlation analysis of pesticide loads with runoff volumes and pesticide concentrations revealed pesticide loads were attributed to runoff volume more than chemical concentrations for both management practices (volume $r = 0.78$ to 0.90 , concentration $r = 0.05$ to 0.22). This greater correlation of pesticide load with runoff volume explains in part the increased pesticide transport associated with the solid tine plots compared to hollow tine plots and the increased difference in pesticide loads between cultivation practices at 2 d compared to 63 d.

Hollow tine core cultivation removed the cores and returned the soil back to the turf while solid tine core cultivation pushed the soil aside to create the channels. As a result one would anticipate greater soil compaction with the solid tine cultivation and increased accessibility of soil adsorptive sites with the hollow tine cultivation. This would influence hydraulic conductivity and infiltration as previously reported (15, 29, 30) as well as pesticide availability for transport (25, 31, 32). The percentage of applied pesticides observed in the runoff is also influenced by the physical and chemical properties of the active ingredient. Chemical degradation was not influential in the present study as the time from chemical application to runoff (30 ± 8 h) was much less than the reported half lives of the compounds of interest (5 to 320 d).

Reduced Risk of Pesticides in Receiving Surface Waters with Hollow Tine Core Cultivation

Calculated concentrations of pesticides in a pond receiving runoff from fairway turf managed with hollow tines or solid tines were compared with published toxicological endpoints for 19 aquatic organisms including fish, amphibians, mollusks, crustaceans, aquatic plants and algae (28).

Toxicological endpoints included the median lethal concentration (LC50) and

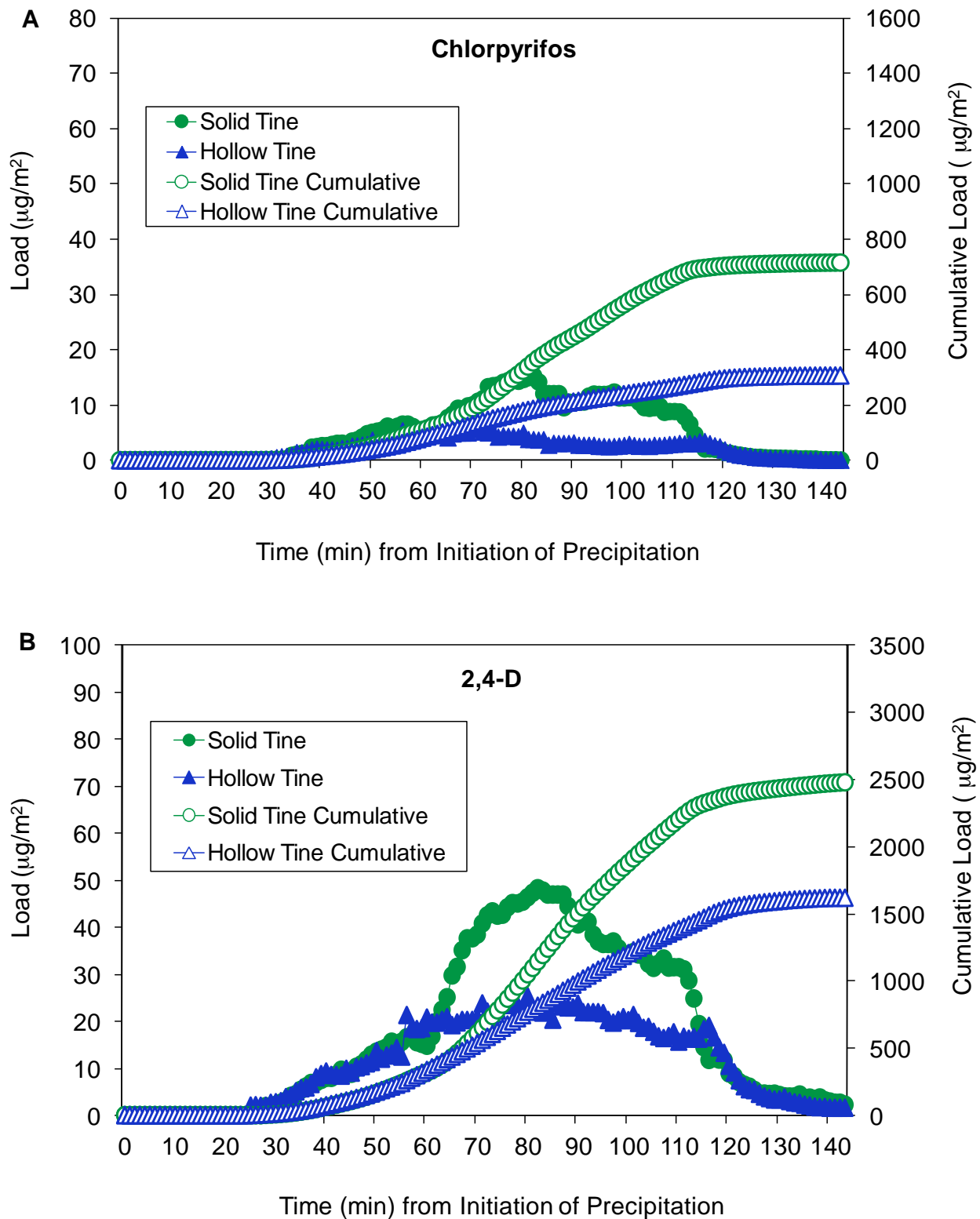


Figure 5. Chemographs and cumulative loads of chlorpyrifos (A) and 2,4-dichlorophenoxyacetic acid (2,4-D) (B) and measured in runoff from turf plots managed with solid tines or hollow tines 2 d prior to simulated precipitation and runoff. Data for dicamba, flutolanil, and mecoprop-p (MCP) at 2 d and all pesticides at 63 d are provided elsewhere (28).

median effective concentration (EC50); or the concentration of a compound that results in the measured effect in 50% of the organisms during a defined exposure period. Pesticide levels in a surface water receiving runoff from turf managed with solid tines exceeded the LC50s or EC50s for eight of the 19 evaluated aquatic organisms. With a few exceptions at 63 d, replacing solid tine core cultivation with hollow tine core cultivation reduced surface water concentrations of chlorpyrifos to levels below the LC50 or EC50 for three fish (Figure 6A), MCPP to levels below the EC50 of a diatom (not shown), and 2,4-D to levels below the EC50 of an aquatic plant (Figure 6B). The sensitivity of rainbow trout, opossum shrimp and water fleas to chlorpyrifos and water fleas to 2,4-D was great enough that surface water levels exceeded the LC50s or EC50s regardless of the turf cultivation practice (ST, HT) (Figure 6A&B). Likewise, changes in management practice did not significantly influence the risk of pesticides to non-sensitive organisms (e.g. organisms who's LC50 is well above the maximum concentration estimated in the diluted surface water) (data not shown). Results of the present research provide quantitative information that will allow for informed decisions on cultural practices that can maximize pesticide retention at the site of application; improving pest control in turf while minimizing environmental contamination and adverse effects associated with the off-site transport of pesticides. Using cultural practices that enhance infiltration and reduce runoff volume will effectively reduce pesticide runoff as demonstrated through the use of HT aerification.

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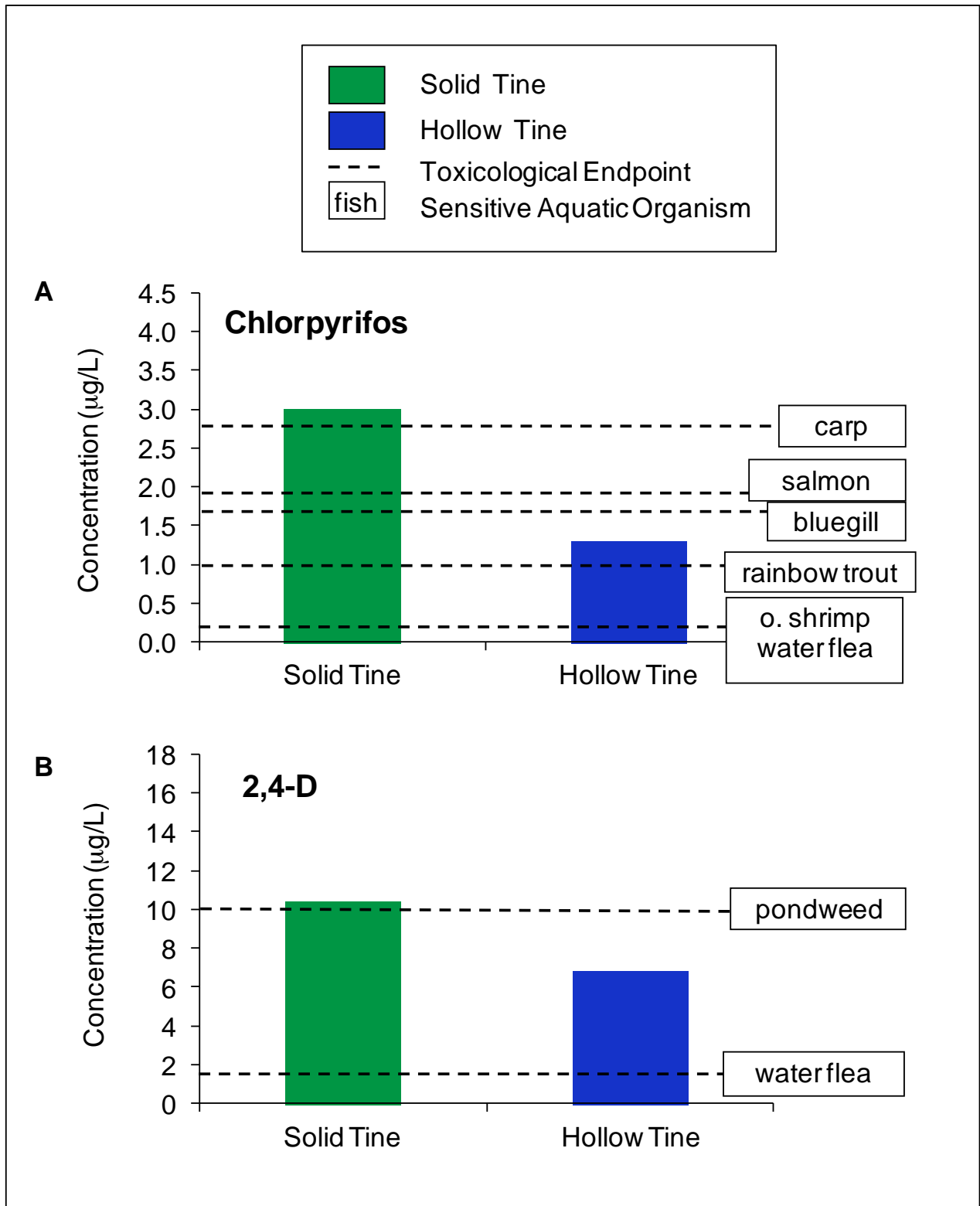


Figure 6. Comparing concentrations of chlorpyrifos (A) and 2,4-dichlorophenoxyacetic acid (2,4-D) (B) in a surface water receiving runoff from fairway turf managed with solid tines or hollow tines 2-d prior to runoff with toxicological end points (median lethal concentrations or median effective concentrations) of sensitive aquatic organisms. Toxicity data available at http://cfpub.epa.gov/ecotox/ecotox_home.cfm.

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WHEREVER GOLF IS PLAYED

The Program: The Minnesota Golf Course Superintendents' Association offers a scholarship program designed to assist children and grandchildren of Class AA, A, SM, C, D, Associate and Affiliate members. The MGCSA provides scholarships to students attending college or vocational programs at any accredited post-secondary institution. The program is independently managed by Scholarship America, a national non-profit student aid service organization. Awards will be granted without regard to race, color, creed, religion, sex, disability, national origin or financial need.

Selection of Recipients: Scholarship recipients are selected on the basis of academic record, potential to succeed, leadership and participation in school and community activities, honors, work experience, a statement of education and career goals and an outside appraisal. Selection of recipients is made by Scholarship Management Services. In no instance does any member of the MGCSA play a part in the selection. Applicants will be notified by the end of July whether they have been awarded or denied a scholarship.

Eligibility: Applicants for the MGCSA Legacy Scholarships must be: children/grandchildren of Class AA, A, SM, C, D, Associate or Affiliate members who have been members of the MGCSA at least five years; High school seniors or graduates who plan to enroll or students who are already enrolled in a full-time undergraduate course of study at an accredited two- or four-year college, university or vocational-technical school, and under 23 years of age.

Awards: Three awards will be given to children and grandchildren of Class AA, A, SM and C members. One award of \$1,500 in the name of Joseph S. Garske will be given to the highest evaluated applicant. That award will be renewable for one year contingent upon full-time enrollment and satisfactory academic performance. One other \$1,000 award will be given to other qualified applicants from this group. One \$1,000 award will be available to children and grandchildren of Class D, Associate and Affiliate members. These awards are not renewable. However, students may reapply to the program each year they meet eligibility requirements. Awards are for undergraduate study only.

Obligations: Recipients have no obligation to the MGCSA or its members. They are, however, required to supply Scholarship Management Services with current transcripts and to notify Scholarship Management Services of any changes of address, school enrollment or other relevant information. Except as described in this brochure, no obligation is assumed by the MGCSA.

Application Deadline: June 1, 2013. For more information go to mgcsa.org



Within the Leather

by David Kazmierczak, CGCS

I am a procrastinator.

It is a character

flaw that I have fought all of my life. Somewhere along the line, the piece of paper proclaiming never put off until tomorrow what can be done today never made it in my initial trapper keeper.

The flaw seems to accentuate itself to some exponential degree when it is something that I do not particularly care to do, or do not seem to have the time for. Just ask my wife of 22 years. She could probably fill an entire magazine full of instances of my procrastination, and those would only be the ones that brought her total consternation. Or is it constipation? I don't know, I think it's one of the two. Anyway, I believe at this point in life, she has accepted and come to terms with the garden variety procrastination. I she hadn't, I would be living at the shop out of necessity.

So, it with this admission/revelation, that I bring you this months' editorial column. Honestly? I have nothing. I always have wanted to be that guy who writes on hard-hitting topics with deep meaning, or exposing a new idea or shine light on a person who has done something brilliant or heroic or admirable. I am sure there are some of those stories out there, but I got none of them.

I have great excuses. Procrastinators are never short of excuses. Most of

them currently center around the fact that we are trying to stuff two months worth of work into two weeks before Memorial Day weekend, the unofficial official start of summer. This is the time when a golf course in Minnesota should be rounding into peak condition. We are not even close. We are getting there at Prestwick, and we were pretty much spared the ravages of the awful winter savagery bestowed upon so many area courses (sorry, guys and gals), but we are not there yet.

Mix in a family matters, funerals, birthdays, a few more light excuses and I got no column ideas, content, nothing and I'm pretty sure Jack MacKenzie, the Publisher of this fine turf rag, needed my column yesterday. So I'm going to wing it with random thoughts on this silly business we love so much: Andy Rooney style....

Ever wonder why an irrigation head sticks on overnight in the wettest spot on the golf course. It never sticks on over that troublesome dry hump. And the probability of it sticking on is proportional to the importance of the day. Member-guest tournament- you bet; random Tuesday in April, 40 degrees, not a chance.

And while we are on the subject of irrigation, why is it the most likely irrigation box not to run overnight is the one that operates the first hole? And why is it usually on a Saturday? If it's the box on 18, I have time to run the dang thing before play starts. First hole? Pack a lunch.

And why is the irrigation head always pointing at my cart when I turn the thing on to check it? You would think with a 360 degree radius I'd have a pretty good