Baseball Field Integrated Pest Management Training

Tim Stock, Cole Stover, Zach Hamilton, Chas Schmid Ph.D. and Alec Kowalewski Ph.D.
Durham Rd, Tigard, OR 97224
8:00 AM to 10:00 AM

30 minutes – **Infield Maintenance:** This field stop will highlight methods for weed prevention and removal within a baseball or softball field. This will focus on mechanical removal and grooming with infield maintenance tools. Nonselective preemergence and postemergence herbicides will also be highlighted.

Speaker: Cole Stover, Graduate Assistant, cole.stover@oregonstate.edu

30 minutes – **Weed Identification and Selective Herbicide Selection**: This presentation will focus on weed identification in the outfield and sideline areas. Weeds will be identified and categorized as perennial, biannual or annual, as well as broadleaf, grass or sedge. Selective preemergence and postemergence herbicides will also be recommended and discussed.

Speaker: Zach Hamilton, Graduate Assistant, zachary.hamilton@oregonstate.edu

30 minutes – **Alternatives to Glyphosate**: This presentation will highlight research at OSU evaluating registered pesticides as potential alternatives to glyphosate. All of these products are non-selective products. Discussion will include herbicide action word, which varies from caution to danger, and duration of control, which ranges from weeks to days.

Speakers: Tim Stock, Senior Instructor II, tim.stock@oregonstate.edu

Alec Kowalewski, Ph.D., Associate Professor, alec.kowalewski@oregonstate.edu

30 minutes – **Backpack Sprayer Modification and Calibration**: This field presentation will highlight the steps necessary for proper backpack sprayer calibration. Including items such as proper PSI, carrier volume, and walking speed. Attendees participating in this training will learn how to calibrate a backpack sprayer to a carrier volume of 1 to 2 gallons per 1,000 sq ft after attending this training. Discussion will also include the proper amount of product per gallon when mixing pesticides into a backpack sprayer.

Speaker: Chas Schmid, Ph.D., Research Associate schmchar@oregonstate.edu

Infield Maintenance: Cole Stover

The dirt areas of the infield should be raked before and after every practice during the season to prevent weed establishment and improve the infield playing conditions. It would be best to incorporate the players and volunteers into these aspects of the field maintenance. In addition to frequent hand raking, more aggressive cultivation can be done periodically with a nail drag rake.

Hand raking before and after practice will help prevent weed establishment and provide a smooth infield (left), a nail drag is more aggressive than hand rakes, small and large version are available (right).

After the playing season the dirt areas of the infield should be tarped to prevent weed germination, and the development of algae. If a tarp is not feasible a pre-emergent herbicide like pendimethalin (Pendulum) or prodiamine (Barricade) applied in the early spring or early fall could also be used to prevent weeds from germinating. We have identified summer annuals (knotweed) and winter annuals (annual bluegrass and pineapple weed), which would be controlled nicely with spring and fall pre-emergent herbicide applications, respectively. The use of pre-emergence herbicides in place of a tarp will result in more weed cleanup prior to the start of the season.

Infield tarps will prevent weed establishment and reduce spring clean-up.

Weed Identification and Selective Herbicide Selection: Zach Hamilton

Weed	Weed Lifecycle	Herbicide Timing	Active Ingredient
Black Medic (*Medicago lupilina*)	Summer annual	**Pre-emergent:** Spring	Pendimethalin or Dithiopyr
Broadleaf and Buckhorn Plantains (*Plantago major, P. lanceolata*)	Perennial	**Post-emergent:** Fall	2,4-D or Carfentrazone-ethyl
Bull Thistle and Canadian Thistle (*Cirsium vulgare, C. arvense*)	Perennial	**Post-emergent:** Fall	Triclopyr or 2,4-D
Clover (*Trifolium spp.)*	Perennial	**Post-emergent:** Fall **Fertilizer:** 4 lbs N/ 1000 sqft annually	Triclopyr **Fertilizer:** 4 Nitrogen
Crabgrass (*Digitaria spp.*)	Summer annual	**Pre-emergent:** Spring	Dithiopyr
Dandelion (*Taraxacum officinale*)	Perennial	**Post-emergent:** Fall	Triclopyr or 2,4-D
English Lawn Daisy (*Bellis perennis*)	Biennial	**Post-emergent:** Fall	2,4-D, Dicamba, or Triclopyr
Knotweed (*Polygonum aviculare*)	Perennial	**Post-emergent:** Fall	Dicamba or Triclopyr
Lawn Violet (*Viola papilionaceae*)	Perennial	**Post-emergent:** Fall	Triclopyr, 2,4-D, or Dicamba
Pineappleweed (*Matricaria matricarioides*)	Summer and Winter annual	**Pre-emergent:** Spring or Fall	Pendimethalin or Dithiopyr
Prickly Lettuce (*Latuca serriola*)	Biennial	**Post-emergent:** Fall	2,4-D, Dicamba, or Triclopyr
Puncture vine (*Tribulus terrestris*)	Summer annual	**Pre-emergent:** Spring	Pendimethalin or Dithiopyr
Purslane (*Portulaca oleracea*)	Summer annual	**Pre-emergent:** Spring	Pendimethalin or Dithiopyr
Sowthistle, Annual (*Sonchus oleraceus*)	Summer annual	**Pre-emergent:** Spring	Mesotrione or Sulfentrazone
Speedwell (*Veronica spp.*)	Perennial	**Post-emergent:** Fall	Triclopyr or Dicamba
Spotted Spurge (*Euphorbia maculata*)	Summer annual	**Pre-emergent:** Spring	Pendimethalin, or Dithiopyr
Woodsorrel (*Oxalis spp.*)	Perennial	**Post-emergent:** Fall	2,4-D, Triclopyr, or Dicamba

Footnote: Fall is the optimum time to control perennial weeds with a single post-emergent application. Spring treatments will often require two applications, if you are unable to apply a treatment in the fall. Do not apply these products when temperatures are greater than 80 degrees. For annuals apply a pre-emergent herbicide.

Alternatives to Glyphosate: Effects of non-selective herbicides on a mixed lawn in western Oregon

Clint Mattox Ph.D., **Tim Stock,** Leslie Beck, Bernd Leinauer Ph.D., and **Alec Kowalewski Ph.D.**

Introduction:

Pesticide restrictions in urban areas are encouraging stakeholders to seek herbicide alternatives; therefore, a field experiment took place over 8 weeks in western Oregon comparing 11 non-selective herbicides for the suppression of vegetation in a mixed stand of turfgrass and broadleaf weeds.

Methods and Materials:

Applications began on April 15th, 2022 and were made every two weeks for a total of four applications (glyphosate was only applied on the first application date). Spray carrier volume was two gallons per 1,000 ft^2 and pressure at the boom was 35 psi. Light box images were collected three times a week and digital images were analyzed for percent green color. Treatments included:

- 1% clove oil applied at a 33% volume / volume (v/v) solution
- 44% caprylic acid + 36% capric acid applied at 6% v/v
- 40% Ammonium nonanoate applied at 13% v/v
- 70% d-limonene applied at 25% v/v
- 7.5% sodium chloride applied at 100% v/v
- 22% ammoniated soap of fatty acids + 3% maleic hydrazide applied at 17% v/v
- 45% cinnamon oil + 45% clove oil applied at 5% v/v
- 5% mint oil, 5% sodium lauryl sulfate, 5% potassium sorbate applied at 6% v/v
- 20% acetic acid applied at 100% v/v
- 57% pelargonic acid applied at 10% v/v
- 48.7% glyphosate applied once at a rate of 2.42 oz. per 1,000 ft^2
- Water Control

Results:

On every rating date occurring two weeks post application, glyphosate had a lower percent green color percentage compared to all other treatments. On these same rating dates, every treatment had a lower percent green color than the water control with the exception of mint oil + sodium lauryl sulfate + potassium sorbate on all four dates and clove oil on the June 10th rating date (Table 1 and Figure 1).

	Apr 29	May 13	May 27	Jun 10
Clove oil	68% b[1]	72% b	79% b	86% a
Caprylic + Capric acid	59% bc	53% c	58% cd	58% bc
Ammonium nonanoate	49% cd	47% cd	55% de	60% bc
D-limonene	53% bcd	54% c	55% de	64% b
Sodium chloride	50% cd	50% c	52% def	53% cd
Ammoniated soap of fatty acids + Maleic hydrazide	54% bcd	37% d	45% ef	47% d
Cinnamon oil + Clove Oil	64% bc	65% b	67% c	68% b
Mint oil + Sodium lauryl sulfate + Potassium sorbate	84% a	86% a	89% ab	88% a
Acetic acid	39% d	37% d	44% ef	51% cd
Pelargonic acid	50% cd	37% d	43% f	54% cd
Glyphosate	13% e	1% e	1% g	4% e
Water	89% a	90% a	92% a	90% a

Table 1: The effects of non-selective herbicide treatments on percent green cover of a mixed stand of grasses and broadleaves in Corvallis, OR. Treatments began 15 Apr 2022 and were applied every 2 weeks. Ratings listed represent percent green cover 2 weeks after each application. [1]Means in the same column followed by the same letter are not statistically significant according to Tukey's Test at $P \leq 0.05$

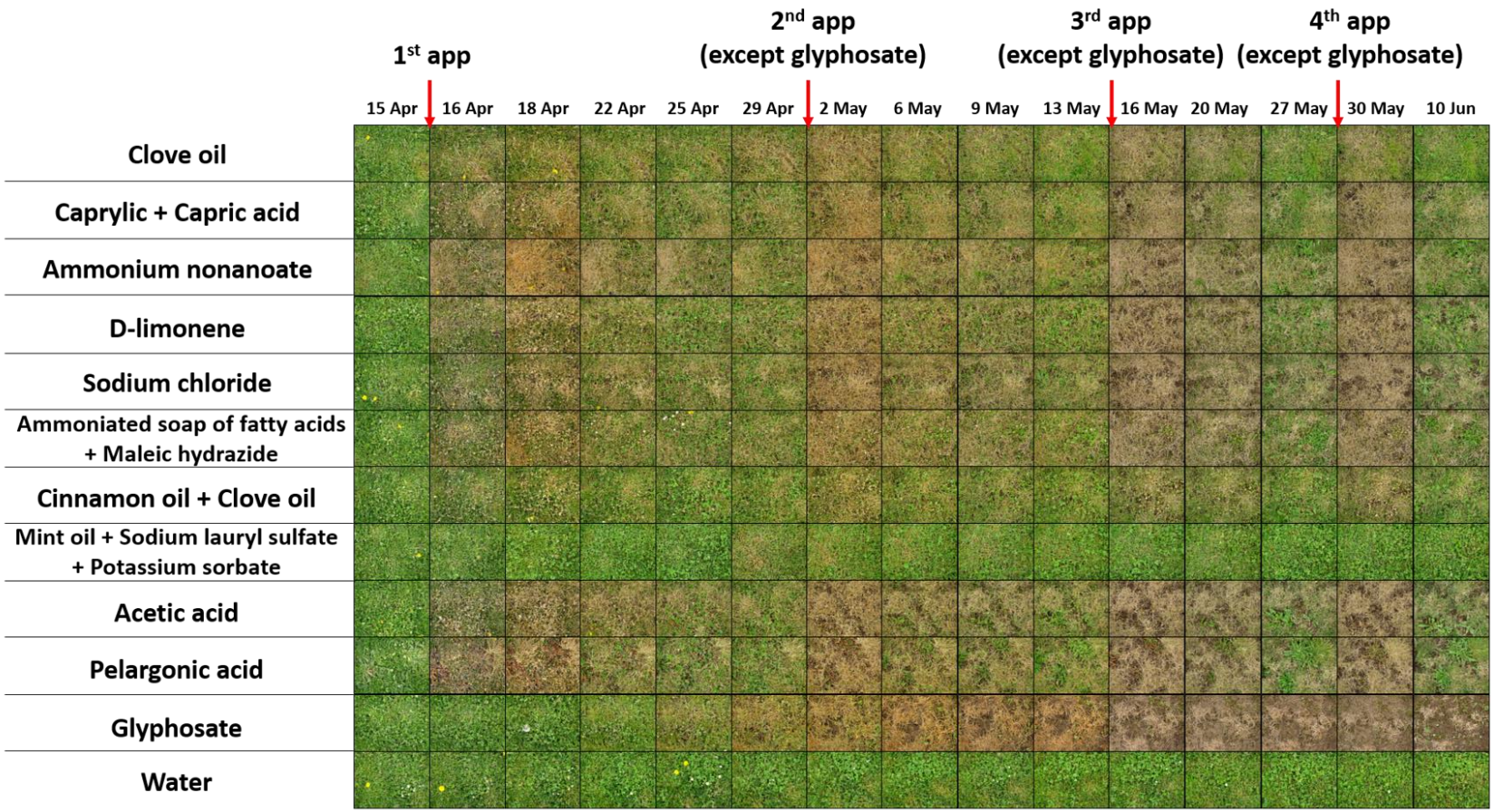

Figure 1: Light box images of plots representative of non-selective herbicide treatment effects over time on a mixed stand of grasses and broadleaves in Corvallis, OR. Treatments began 15 Apr 2022 and were applied every 2 weeks (with the exception of glyphosate, which was only applied on 15 Apr 2022).

Backpack Sprayer Modification and Calibration

Chas Schmid, Ph.D.

Calibration of backpack sprayers to determine sprayer output (in gal/1,000 ft^2) is controlled by three factors: walking speed, nozzle output, and spray width. The following steps will walk you through how to determine each of these factors and calculate your backpack sprayer output.

1. Walking speed (MPH) – Mark off two points 100 ft apart on the surface you will be spraying. Record in seconds how long it to travel the distance. Repeat this step until you achieve a consistent travel speed. It is important to find a walking speed you can maintain throughout the spray; DO NOT walk too FAST! Then calculate walking speed in mph by dividing 68.18 by the time required to travel 100 ft (in sec). *Example 68.18 / 34 sec = 2.0 mph*

2. Nozzle output (GPM) – It is important to use a CF valve on backpack sprayers to maintain constant pressure which will make calibration much easier. The nozzle output in gallons per minute (GPM) can be determined by looking up the manufacturers GPM specifications (i.e. TeeJet Catalog) or can be measured directly with the following procedures:

a) Fill sprayer half full of water.
b) Pump the sprayer to pressurize the tank
c) Pull the handle trigger, start timer for 60 seconds, and collect spray output in a measuring container.
d) Determine volume collected and convert the flow rate to gallons per minute (128 fl oz = 1 gal)

3. Spray width (W; inches) – It is important to hold your spray boom at a constant height to ensure that you maintain a consistent spray width. To determine your spray width, find a comfortable boom height that you can maintain for an extended period (not too high or low). Find an area of dry concrete or gravel and spray a test strip using water (*make sure to maintain constant height). Measure the width (inches) of the spray pattern left on the concrete/gravel

Calculate Sprayer output using the following equation:

$$gal/1000\ sq\ ft = \frac{136 * GPM}{MPH * W}$$

Backpack Sprayer Modification Parts List

Image	TeeJet Part #	Description
	11990-61	Female X hose shank (1/4" N.P.S. x 3/8 hose)
	4727	Sure Grip Handle - brass
	6466	Trigger Valve - brass
	6671-24	Spray gun extension - curved with fixed body, 24"
	-----	Constant Flow Valve (CF Valve) - G.A.T.E., Jacto, or Chapin; **Must be 11/16' thread**; yellow = 15 psi, Red = 21 psi and Blue = 29 psi
	QJT-NYB	Quick TeeJet - 11/16' thread
	CP25607-4-NY	Quick TeeJet caps - full circle, no alignment notch
	CP18999-EPR	Rubber seal gasket - notched; *order extra to replace worn gaskets
	8079-PP-50	TeeJet Strainer - Polypropylene, 50 mesh; *order extra to replace clogged screens
	See catalog	TeeJet spray tips - air induction XR Flat, air induction, extended range flat, twin flat, flood jet, or **Even** flat (spot treatment)
	----	Hose clamps; crimp type preferred
	----	Thread sealant tape

*Material adapted from https://sustainable-farming.rutgers.edu/backpack-sprayer-modification/