

Weed Science, PLS 4601c Section 7644  
and Grad. – Prin. Of Weed Science AGR 6932 Section 9212  
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## **Herbicides labels and application**

### **1. The pesticide label**

Learn to recognize the 15 parts of EPA pesticide labeling and the importance of the pesticide label.

### **2. Validating that your equipment procedures are accurate and safe**

Check the nozzle discharge rate, ground speed, nozzle spacing, boom height, nozzle type, and equipment condition. Check your equipment for leaks and operation hazards.

### **3. Calculating pesticide rates and converting units of measurement**

How to calibrate a boom sprayer to deliver 40 gallons per acre and determine how much product to add to cover 10 acres. Simple dimensional analysis will be introduced to give student confidence in solving conversion problems with no external aids.

### **4. Record what you did**


Keep a written record of what you did.

## 1. The pesticide label

**Pesticide Label Format (Adapted from the EPA “Label Review Manual,”**  
<http://www.epa.gov/oppfead1/labeling/lrm/chap-03.htm> )

These are the sections of the label in the *approximate* order on a label.

### A. Front Panel

1. **Restricted Use Pesticide Statement**
2. **Product Name, Brand or Trademark.** Identifying information; the “Type of Product” (e.g., “Herbicide for controlling annual and perennial grass and broadleaf weeds in lawns” is usually included here as well).
3. **Ingredient Statement** The name and the percentage by weight of each active ingredient and the percentage by weight of other/inert ingredients.
4. **"Keep Out of Reach of Children" (KOOROC) Statement.** This specific statement, which is commonly referred to as the KOOROC statement ("child hazard warning"), appears on almost all end use pesticide products.
5. **Signal Word.** Signal words that correspond to the toxicity categories for product hazards
6. **First Aid.** A first aid statement must appear on the front panel of all pesticides assigned to Toxicity Category I by any route of exposure, but the agency may allow reasonable variations in the placement of the statement. The front panel must include a reference such as “See First Aid statement on back panel” near the word “poison” and the skull and crossbones if the Agency allows the first aid information to appear on the back panel. First Aid statements for pesticides of other Toxicity Categories may appear on any panel of the label.
7. **"Skull & Crossbones" Symbol  and the word "POISON"**  
Labels of pesticides that contain substances in quantities highly toxic to man must include a skull and crossbones and the word “poison” prominently in red on a background of distinctly contrasting color.

**8. Net Contents/Net Weight**

Weight or volume of pesticide in the container.

**B. Front or Back Panel**

9. **EPA Registration Number & Establishment Number.** The EPA Registration Number is the single most important piece of information for tracking pesticide products. The EPA Establishment Number identifies the final physical location where the pesticide product was produced or labeled.

**10. Company Name & Address****C. Back Panel****11. Precautionary Statements**

- a. **Hazards to Humans and Domestic Animals.** Where a hazard exists to humans or domestic animals precautionary statements that describe the particular hazard, route of exposure and precautions to be taken must appear on the label. Examples may include a delayed effects statement and an allergenic effects statement.
- b. **First Aid.** This section of the label provides information to the pesticide user concerning appropriate first aid for the various routes of exposure associated with accidental exposure.
- c. **Environmental Hazards.** Where a hazard exists to non-target organisms, precautionary statements that identify the hazards and necessary precautions must appear on the label.
- d. **Physical or Chemical Hazards.** Hazards such as flammability, explosive potential or dielectric breakdown and the various precautions to be taken must be identified, as applicable.

12. **Directions for Use.** This section of the label provides instructions to the user on how to use the product, and identifies the pest(s) to be controlled, the application sites, application rates and any required application equipment. This section may also include certain worker protection issues such as a reentry statement that identifies the specific time period

following treatment during which entry into a treated area is restricted.

13. **Storage and Disposal.** Instructions for storing the pesticide product and for disposing of any unused pesticide and the pesticide container.
14. **Warranty Statement.** This is a disclaimer statement included **voluntarily** on most pesticide products by the registrant.
15. **Worker Protection Labeling**

**Directions for Use**

	<b>Aatrex 4L</b>	<b>Arsenal Railroad Herbicide</b>	<b>Trimec Turf Herbicide</b>
<b>Pests controlled</b>			
<b>Plants protected</b>			
<b>Site intended</b>			
<b>Form applied</b>			
<b>Correct Equipment</b>			
<b>How much to use</b>			
<b>Carrier volume</b>			
<b>Mixing directions</b>			
<b>Tank mixtures</b>			
<b>Unwanted effects</b>			
<b>Where applied</b>			
<b>When applied</b>			
<b>Special precautions</b>			
<b>Reentry</b>			
<b>Other</b>			

## 2. Validating that your equipment procedures are accurate and safe

### a. Equipment: Measure your sprayer

Characteristic	Measured value	Unit of measurement
Boom width	<b>14</b>	<b>feet</b>
Boom height (to nozzle tips)	<b>20</b>	<b>inches</b>
Nozzle number	<b>15</b>	
Nozzle spacing	<b>12</b>	<b>inches</b>
Nozzle brand	<b>Tee Jet</b>	
Nozzle model	<b>11002</b>	<b>11002</b>
Nozzle type	<b>flat fan</b>	
Angle	<b>110</b>	<b>degrees</b>
Nominal discharge	<b>0.2</b>	<b>gallons / minute</b>
Measured discharge	<b>400</b>	<b>ml / 30 sec</b>
Ground speed	<b>4</b>	<b>miles per hour</b>

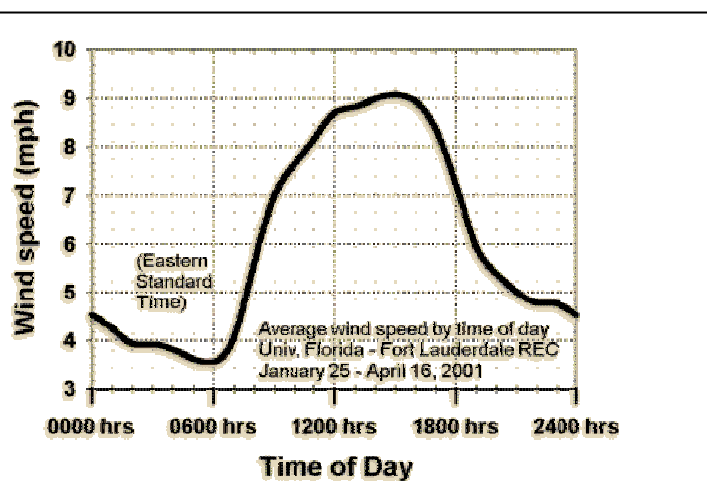
### b. Equipment: Check function

Check your equipment for leaks and operation hazards.

### c. Conditions: The weather

Spray drift by wind can damage neighboring desirable plants, and even damage turf, as the weed killing chemical is blown into concentrated areas. If one knows when to expect wind, it's a lot easier to schedule spraying when there is reduced chance of wind drift.

To see up-to-the-last-15-minutes wind speed at many stations in Florida, you can visit [fawn.ifas.ufl.edu](http://fawn.ifas.ufl.edu) and to see what the wind speed in South Florida will be in the next two days, visit: [www.srh.noaa.gov/mfl/](http://www.srh.noaa.gov/mfl/)



Wind speed is often a predictable factor in turfgrass culture. Values were measured 2 feet above the ground and averaged across dates, at U of F - Fort Lauderdale, located in Davie, Broward County, Florida.

The time just before and after sunrise is often comparatively free of wind. Afternoons are breeziest. This graph shows how extreme and how predictable the effect is in South Florida. The same pattern would not be so consistent for other areas even within Florida, for example areas in northern Florida such as Gainesville are influenced by different prevailing wind patterns.

Normally, the applicator should spray pesticides when the wind is less than 5 miles per hour, certainly less than 10 miles per hour, depending on the spray droplet size and the elevation of the spray nozzles above the ground, and whether there shielding.

In the example from the FAWN automatic weather station University of Florida Fort Lauderdale Research and Education Center, during predawn hours, before about 0700 hours in the morning, wind averaged less than 4 miles per hour. But after 0800 hours the graph shows that wind averaged more than 5 miles per hour. On any given day, higher or lower wind speeds were encountered, but knowing the average wind speed for a time of year is a good place to start for planning maintenance activities. Wind, at least, is more predictable than rain.

Reported wind speed is only relative, because it is much windier high above the ground. Small droplets sprayed a few feet above the ground can drift entirely away from the intended target, even in a 5-mile-per-hour wind.

In 1686, four years after he saw the famous comet that bears his name, British astronomer Sir Edmund Halley explained the trade wind and other large-scale wind movements by differences in terrestrial heating.

### 3. Calculating pesticide rates and converting units of measurement

GRIN: 4 steps to convert (almost) anything

## Given Required Identity Nullify

Precision application depends on precise conversion of units of measure. Some real examples were generated in class as part of a [calibration test](#).

Turfgrass managers must accurately mix and apply chemicals and other materials. Examples include the use of herbicides, irrigation water, and wetting agents. Reasons to be accurate are the cost of material, its narrow window for selectivity, and the law. It is a violation of Federal law to apply a pesticide in a manner inconsistent with the label.

Inaccuracy can occur many ways, with serious consequences. It takes only a tiny math error, in converting units of measure, to cause a lethal overdose of product per unit area. What wasn't noticed in the pencilled notes becomes obvious when the lawn dies.

Herbicides sometimes cost more than \$100 per pound of active ingredient. But the price of wasted product is not what the turfgrass manager is thinking, when he has to explain to a client that he has just "smoked" her yard. Professional Pest Control? "Nice uniforms, but can't multiply."

Precise application is a powerful business advantage in turfgrass management. So how do you convert units to get the math part right? Don't depend on what most people do. Be able to GRIN, also called also called factor analysis, unit analysis, and factor-label method, and dimensional analysis.

Most turfgrass conversions are based on rules of thumb. You "know" your spray tank covers 2 acres, the label says, "apply 1 pound per acre," so it's pretty obvious that to spray one full tank, you need to throw in 2 acres of product, that is, 2 pounds, per tankful. Simple problem, no risk in figuring it in your head? Yes, R-I-S-K. Because when you change out the nozzles, you might not get 2 acres from one spray tank. Or what happens if you have to switch to a different spray tank? And the person who used it last isn't around to tell you how much it sprays. What do you do? Just GRIN

GRIN is a simple bookkeeping system for getting the math right.

**G = Given**, i.e., what are you given to do? Apply 1 pound of product per acre and apply product to 2 acres.

**R = Required**, i.e., what are you required to do? Put so many pounds of product in a spray tank. When you convert, what is required is always equal to what is given.

**I = Identity**, i.e., what units are identical? As an example, area covered by one spray tank = 2 acres. We could express this as a fraction,

$$1 = (2 \text{ acres/area covered by spray tank})$$

The nice feature of this is that the identity principle says you can multiply any expression by 1 and not change it. So, gather all similar identities and write them into a formula. I'll show you in the example how this is done.

**N = Nullify units**. Whenever you have a unit of measure, such as acres, which occur once in a denominator, and in another place in a numerator, just cancel them both out.

Other than a little multiplication, you're done.

### An example

Sports Park Manager Leslie is purchasing fertilizer to apply to four football fields and adjacent turf areas, totaling 6.5 acres. The fertilizer being purchased is 16-4-8 analysis (16% nitrogen) and it is to be applied at 1 pound of nitrogen per thousand square feet. Fertilizer bags contain 50 pounds of fertilizer. How many bags should she buy?

**G = Given**, 1 pound N per thousand square feet and 6.5 acres.

**R = Required**, number of bags of fertilizer.

Required =	Given	
Amount =	Rate	x Basis
	1 pound N	
number of bags fertilizer =	_____	x 6.5 acres
	1000 ft <sup>2</sup>	

**I = Identity**, 1 bag fertilizer = 50 pounds fertilizer; 1 unit fertilizer = 0.16 units N; 1 acre = 43,560 square feet

Amount =	Rate	x Basis	Identities		
	1 pound N		1 bag	fertilizer	43,560 square ft <sup>2</sup>
number of bags fertilizer =	_____	x 6.5 acres x	_____	x _____	x _____
	1000 ft <sup>2</sup>		50 pounds	0.16 N	1 acre

**N = Nullify units.** Whenever you have a unit of measure, such as acres, which occur once in a denominator, and in another place in a numerator, just cancel them both out. Items in red are being canceled.

Amount =	Rate	x Basis	Identities		
	1 pound N		1 bag	fertilizer	43,560 ft <sup>2</sup>
number of bags fertilizer =	_____	x 6.5 acres x	_____	x _____	x _____
	1000 ft <sup>2</sup>		50 pounds	0.16 N	1 acre

Other than a little multiplication, you're done.

$$\text{number of bags fertilizer} = (43,560 * 6.5 \text{ bag fertilizer}) / (1000 * 50 * 0.16) = 35.4 \text{ bags}$$

So Leslie buys one pallet containing 40 bags, and has a margin of a few extra bags.

**Comments**

What's required and what's given are sometimes difficult to put together. There are three basic relationships:

$$1. \begin{array}{l} \text{Required} = \text{Given} \\ \text{Amount} = \text{Rate} \times \text{Basis} \end{array}$$

$$2. \begin{array}{l} \text{Required} = \text{Given} \\ \text{Rate} = \text{Amount} / \text{Basis} \end{array}$$

$$3. \begin{array}{l} \text{Required} = \text{Given} \\ \text{Basis} = \text{Amount} / \text{Rate} \end{array}$$

**Conversions to memorize:**Distance

1 km = 1000 m  
 1 m = 100 cm  
 1 m = 1000 mm  
 1 mile = 5280 ft  
 1 yd = 3 ft  
 1 ft = 12 in  
 1 in = 2.54 cm

Area

1 hectare = 10,000 m<sup>2</sup>  
 1 acre = 43,560 ft<sup>2</sup>

Volume

1 liter = 1000 ml  
 1 ml = 1 cm<sup>3</sup>  
 1 gallon = 128 fluid  
 oz  
 1 gallon = 3785 ml

Weight

1 kg = 1000 g  
 1 ton = 2000 lb  
 1 pound = 16 oz  
 1 pound = 454 g  
 1 g water = 1 ml water

**Why do GRIN?**

This is a good method because: (1) it involves a logical, one-step setup; (2) it involves no mental gymnastics; (3) there are only three metric-to-English conversions needed to solve

most problems; (4) GRIN can be applied to all kinds of situations; and (5) it never yields a wrong answer.

**4. Record what you did**

Owner or tenant	Name	Trustees of the Internal Improvement Trust Fund (TIITF)	
	Street address	115 S. Andrews Ave.	
	City	Fort Lauderdale	
	State	FL	
	Zip code	33301-1801	
	County	USA	
Applicator	Name	Philip Busey	
	License number	PB8772	
	Street address	837 SW 120th Way	
	City	Davie	
	State	FL	
	Zip code	33325	
	County	Broward	
Authorizing person	Name	Philip Busey	
Treatment location	Name	Fort Lauderdale Research and Education Center, IFAS/University of Florida	
	Street address	3205 College Ave.	
	City	Davie	
	State	FL	
	Zip code	33314	
	County	Broward	
	Description	Area northwest of pumphouse	
	Range, township, section	26.08754°N, 80.23904°W Section 22 Range 41 East Township 50 South	
	Legal description	NEWMANS SURVEY SUB NO 1 & 2 2-26 D 22-50-41 COMM AT SW COR OF TR 9 TIER 45, NWLY 15 TO C/L OF 30 ST R/W,NELY	
Mixing location	Street address	3205 College Ave.	
	City	Davie	
	State	FL	
	Zip code	33314	
	County	Broward	
Treatment site	Area treated	1760.00	sq ft
	Pest	Globe and other sedges	

	Crop	St. Augustinegrass and adjacent ornamentals	
	Type of site	Mixed landscape	
When applied	Date	2/26/2008	
	Start time	7:30 AM	
	End time	9:00 AM	
Application method	Boom width	3	ft
	Width treated	4.0	ft
	Plot length	110.0	ft
	Replicates	4	
	Length treated	440.00	ft
	Nozzles	4.0	
	Effective nozzles	4.0	
	Adjacent passes	1	
	Superimposed passes	1	
	Nozzle spacing	1	ft
	Hand held	yes	
	Pressure source	pressurized carbon dioxide	
Pressure	40 psi		
Nozzle	Model	11002	
	Type	flat fan	
	Spray angle	110 degrees	
	Ground speed	3	mph
	Discharge ml/sec	12.47	
	GPM observed	0.198	
	Nominal gpm	0.200	
Ambient conditions	Initial time	8:30	
	Wind speed	5.8	
	Wind direction	305.2	
	Mid time		
	Mid speed		
	Mid direction		
	Final time	9:30	
	Wind speed	3.9	
Wind direction	329.4		

	Air temperature		
	Sky condition	Clear	
Product	Brand name	Image 1.5 LC	
	Manufacturer	American Cyanamid	
	Active ingredient	imazaquin	
	Formulation	Liquid concentrate	
	Concentration (ai/unit)	1.5	lb/gal
Labeling	EPA registration	241-303	
	EPA Est.	5905-GA-01	
	Lot number		
	Release date		
	Special labeling, restrictions	Do not apply directly to or within 4 ft of golf course putting greens	
	Environmental hazards		
Application amounts	Target product / acre	42.67	oz/A
	Target ai/acre	0.50	oz/A
	Carrier tank	2	L
	Tanks	4	
	Carrier total mix	8	L
	Carrier rate	32.60	gpa
	Carrier applied	1.32	gal
	Product per tank	6.64	ml
	Product total mix applied	26.56	ml
	Product applied	16.55	ml
	Residual	10.01	ml
	Applied rate	0.009	ml/sq ft
	Applied rate	13.89	oz/A
	Applied rate		
	Applied rate (ai)	0.16	lb/acre
	Applied rate (ai)	0.18	kg/ha
Safety	Reentry interval (REI)	12 hours	
	Posting	four sides	

Workers notified	yes	
Required applicator personal protection	Long-sleeved shirt and long pants, shoes and socks.	
Actual applicator personal protection	Coveralls over long-sleeved shirt and long pants, chemical-resistant boots plus socks, nitrile or neoprene gloves	
Required mixer personal protection	Long-sleeved shirt and long pants, shoes and socks.	
Actual mixer personal protection	Coveralls over long-sleeved shirt and long pants, chemical-resistant boots plus socks, nitrile or neoprene gloves	