Water Quality and Pesticide Use

Example of Captan®

Are you spraying what you paid for?

or

Will you pay for what you are spraying?

Case Studies

Captan

- Used to control damping off in nursery
- Nursery began to notice disease.
- Stated spraying Captan
- Disease continued to increase
- Nursery lost 2 million seedlings
- Cause – pH of water

Round-up

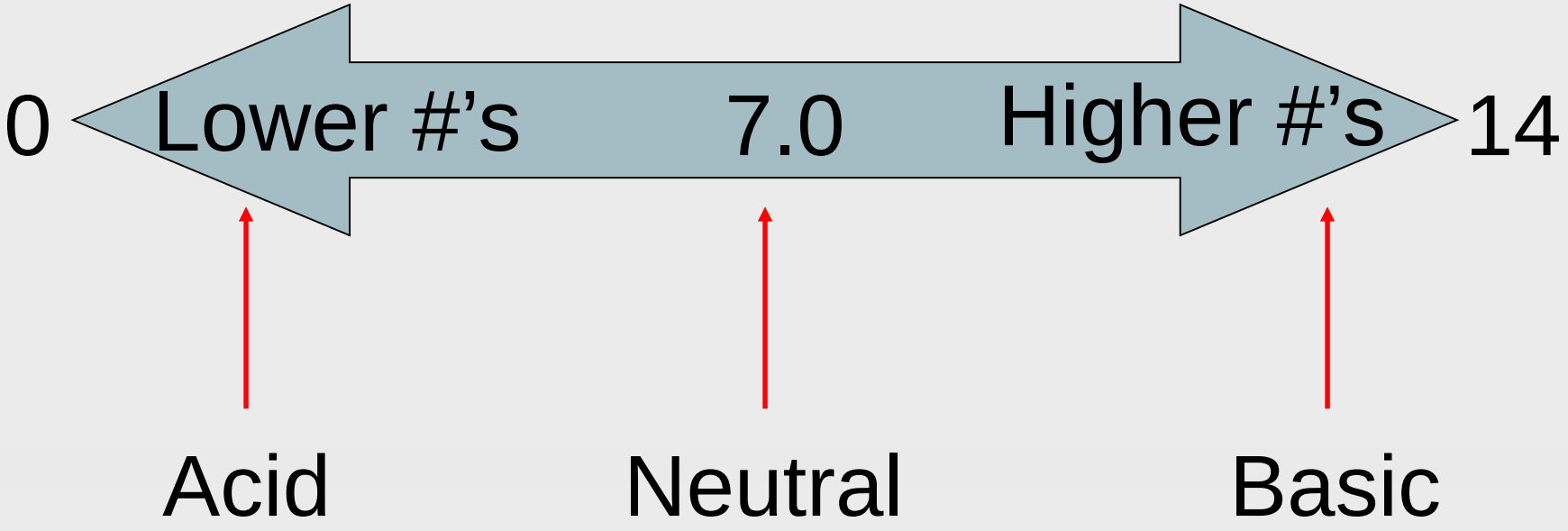
- Nursery used river water source for irrigation and well water for spraying
- Complaint that their Round-up spraying just wasn't working
- Resistant weeds?
- Cause - Hard well water which was preventing Round-up from working

What is pH?

- ***pH*** is the measure of the acidity or alkalinity of a solution.
- Chemically it is formally a measure of the activity of dissolved hydrogen ions (H^+).
- The concept of pH was first introduced* by Danish chemist S. P. L. Sørensen in 1909. The notation “pH" = "power of hydrogen”

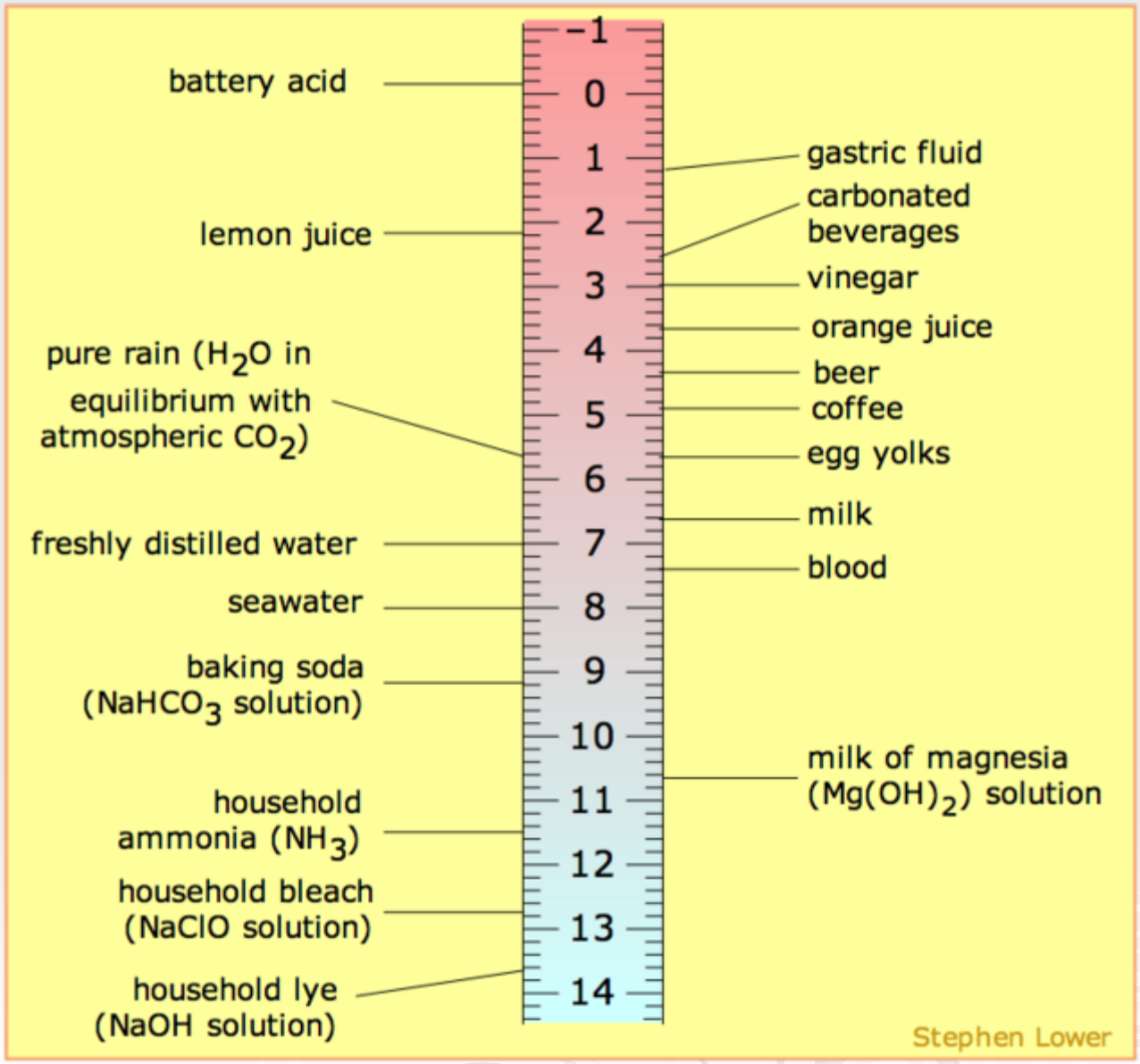
* http://www.carlsberggroup.com/Company/heritage/Research/Pages/pHValue.aspx

pH Range



Logarithmic scale – pH of 8 is 10x more basic than pH of 7

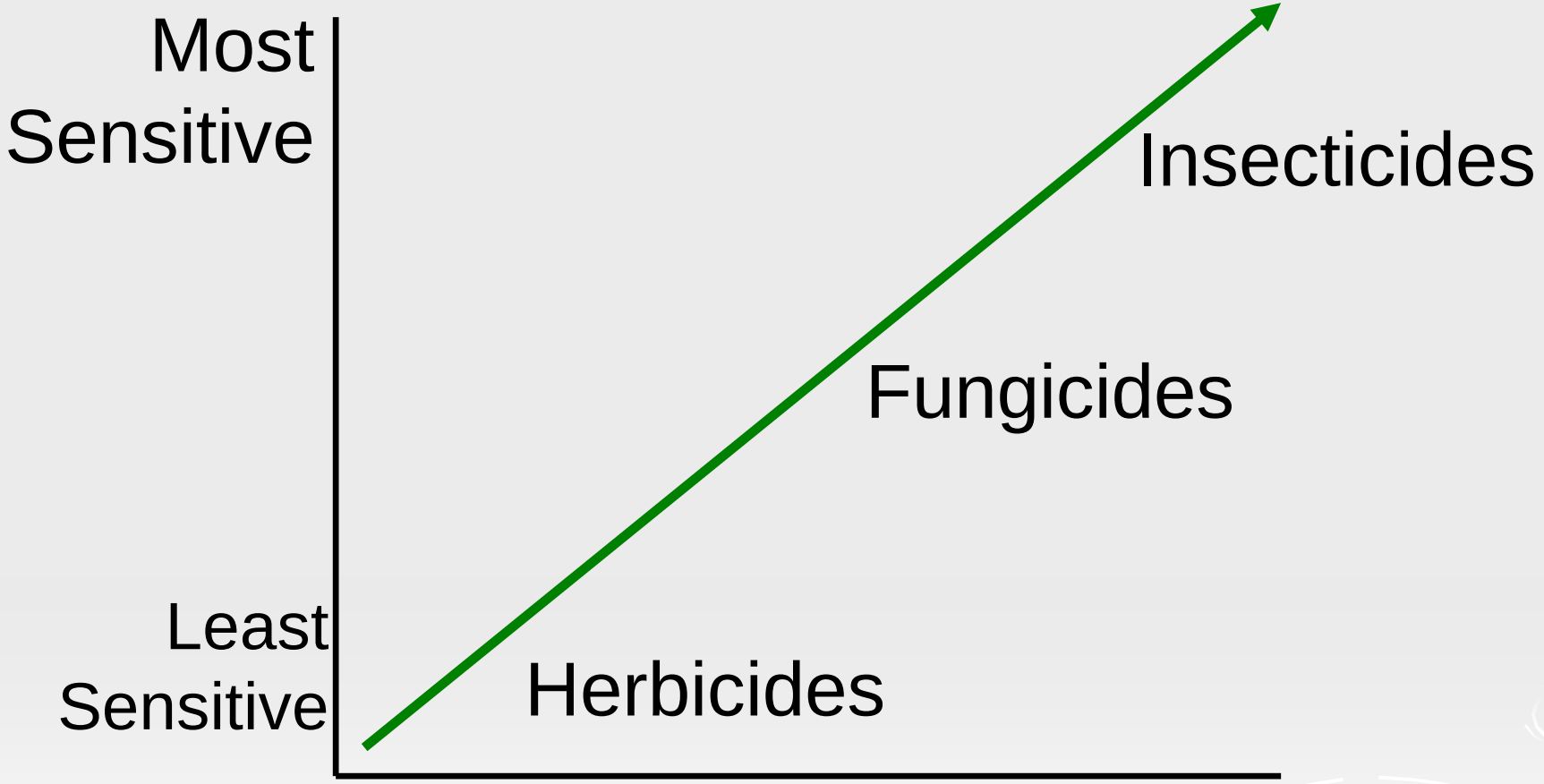
ACID


-1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
battery acid
lemon juice
pure rain (H_2O in equilibrium with atmospheric CO_2)
freshly distilled water
seawater
baking soda ($NaHCO_3$ solution)
household ammonia (NH_3)
household bleach (NaClO solution)
household lye (NaOH solution)
gastric fluid
carbonated beverages
vinegar
orange juice
beer
coffee
egg yolks
milk
blood
milk of magnesia ($Mg(OH)_2$) solution
Stephen Lower

BASIC

Hydrolysis

- Rate at which the chemical breakdown in the presence of water.
- Expressed in terms of “half-life”
- Example – Chemical “A” has a half-life of 1 hour @ pH 8.0.
  - If 1 hr has passed from the time you put the chemical in your spray tank until it dries on the plant surface – 50% of the ai has “broken down”


Most Sensitive
Least Sensitive
Insecticides
Fungicides
Herbicides

Coop Irrigation Water Survey

- **<u>Research Rpt 98-5</u>** – “Results of 1996 Irrigation Water Quality Survey” Mc Nabb & Heidbreder-Olson
- 62 nurseries sampled
- Average pH – 7.0 (4.3 to 10.1)
  - 18 nurseries – 7.0 to 7.5
  - 12 nurseries - 7.6 to 8.0
  - 4 nurseries – 8.1 +

What happened?

pH	*Captan half-life*
5	32 hours
7	8 hrs
8	**10 minutes**
9	**2 minutes**

Solutions & Recommendations

- Do you know the pH & alkalinity of your irrigation water?
  - Has it changed since last year?
- Determine the pH of your water.
  - Note that during drought years the pH of well water will commonly increase (more basic) through the summer.
- Change fungicides
- Buffer the water in your spray tank
  - Nearly all chemical suppliers have buffer agents to adjust pH. Check with your supplier about your use.

Turf & Ornamental, Vegetation Management

Spray Material Half-Life Chart 2007

Adjusting the pH of the spray solution can reduce spray material decomposition and make the spray more effective.
The following chart shows the Spray Material Half-Life or the time it takes for half the amount of chemical to be decomposed (made inactive) various pH levels.

Spray Material Product	Buffering	Optimum pH	Half-Life at pH indicated (50% decomposition)					
			9.0 Base	8.0 Base	7.0 Neutral	6.0 Acidic	5.0 Acidic	4.5 Acidic
2,4-D Amine		6.0			Stable at pH 4.5 - 7.0			
ACCLAIM®		6.5			Stable under acidic conditions			
Allethrin		7.0		Stable at pH 6.0 - 8.0				
ALIETTE®		6.0		Stable at pH 4.0-8.0				
ALUDE®		7.0	Stable 5.0 - 9.0					
ARSENAL®		7.0	Stable over wide range of pH					
ASSAIL®		7.0	Stable over wide range of pH					
ATRAZINE		7.0	Decomposes slowly in base solution					
AVENGE®	X	5.0	Decomposes in strong base condition					
AVID®		7.0	Stable over wide range of pH					
BALAN®		7.0	Not effected by pH					
BANNER®		7.0	Stable over wide range of pH					
BANOL®		6.0	Subject to alkaline hydrolysis					
BARRICADE®		7.0	Stable over wide range of pH					
BASAGRAN®		7.0	Stable over wide range of pH					
BAYGON®	X	6.5		Maintain below 8.0				
BAYLETON®		7.0	Stable over wide range of pH					
BRAVO®		7.0	Stable over wide range of pH					
BROADRANGE™		6.5					Avoid pH below 4.0	
CAPTAN®	X	5.0		10 min.	8 hrs.		32 hrs.	
CARZOL®	X	5.0	2 hrs.		23 hrs.		4 days	
CHIPCO® 26019		7.0	Avoid pH greater than 8.0					
CHLORPYRIFOS		7.0		1.5 days	35 days		63 days	
CHOPPER®		7.0	Stable over wide range of pH					
CLEARY 3336®		6.5	Subject to alkaline hydrolysis above 7.5					
CONFIRM®		7.0	Stable over wide range of pH					
CUTLESS®		6.5	Stable over wide range of pH					
DACONIL® Ultrex		7.0	Stable over wide range of pH					
DACONIL® Weatherstik		7.0	Stable over wide range of pH					
DACTHAL®		7.0	Hydrolized in strong acid and alkaline					
DIAZINON		7.0	29 days	3 wks.	10wks.		14 days	8 days
DICOFOL®	X	5.5	1 hr.		5 days		20days	
DIMETHOATE	X	5.0	48 hrs.			12 hrs.		20 hrs.
DIPEL®		6.0	Unstable in pH > 8					
DIQUAT®		6.0			Stable in neutral or acid solutions			
DI-SYSTON®		7.0	Stable over wide range of pH					
DITHANE®	X	5.5	4 hrs.		17 hrs.		20 days	
DURSBAN®		7.0		1.5 days	35 days		63 days	
DYLOX®	X	5.0		63 min.	6.5 hrs.	3.7 days		
EAGLE®		7.0	Stable over wide range of pH					
ECHO®		7.0	Stable over wide range of pH					
EMBARK®		7.0	Keep pH above 5.5					
ENDORSE®		6.5			Most stable below 7.5			
ENDURANCE®		7.0	Stable over wide range of pH					
FLORAMITE® *Updated*	X	6.5	10 min.		1 hr.	12 hrs.		20 hrs.
FLOREL®	X	5.0	Hydrolized under alkaline conditions					
FORE® *Updated 5-03*	X	5.5	4 hrs.		17 hrs.		20 days	
FUSILADE®		7.0	17 days		21 wks.			65 wks.

You can find a link to the complete document on the Coop Web site.

Water Quality & Roundup®

- http://oregonstate.edu/dept/nursery-weeds/feature_articles/spray_tank/spray_tank.htm written by Dr. James Altland, Oregon State University, North Willamette Research & Extension Center .
- KOC – soil organic sorption coefficient
- Roundup (glyphosate) binds very tightly to soil particles (high KOC value) . Therefore, spraying Roundup on the soil around a weed is of no value.
- Turbid water or water with suspended solids, soil or OM will tie up the Roundup also. Fine particles – harder to see – binds more.

Water Quality & Roundup®

- Glyphosphate kills plants by binding to an enzyme in plant called EPSP synthase.
- In “hard water” (high calcium, magnesium, sodium or iron cations) will bind Glyphosphate.

Water Quality & Roundup®

- Making spray water “hotter”.
  Addition of ammonium sulfate enhances glyphosphate.
  It prevents calcium, magnesium, sodium or iron cations from binding with glyphosphate.