

What's in the Water?

Alkalinity and growing conifers

Elizabeth Lamb, NYS IPM Program

Most of us remember learning about pH in high school chemistry – acids and bases and what happens when you mix them together. That's right – pH is a measure of the concentration of positively charged hydrogen ions dissolved in the water. The higher the concentration, the more acid the water is.

Alkalinity is also based on what is dissolved in the water, but in this case it is the concentration of alkalis – compounds like calcium carbonate – which when dissolved form negatively charged ions. So water with high alkalinity tends to neutralize acids and tends to have a basic pH.

Thanks for the chemistry lesson – why do I need to know this? Because the pH and alkalinity of your water can affect your conifers and any other plants you are growing.

All plant species have soil pH ranges that are optimal for growth. Often they match the conditions where the plants are native. Trying to grow a conifer out of its pH range can result in poor growth or yellowing of needles. Finding exact information on ranges can be difficult but the following table should help.

Species	Optimal pH range
Fraser fir	5.3-5.7 (not above 6)
Balsam fir	4.5-6.0
Canaan fir	5.5-6.5? (higher than Fraser)
Concolor fir	4.5-7.0
Douglas fir	3.7-6.5 (Rocky Mountain 5.5-7.5)
Blue spruce	5.5-6.0
White spruce	4.8-6.5
Scotch pine	5.0-6.0
E. white pine	4.8-7.4

Soil pH can also affect soil fertility. Some nutrients get tied up in compounds that can't be taken up by the tree's roots at certain pH levels. For example, nitrogen, potassium, calcium and magnesium all become less available to plants at pH's below 6. If you are growing your trees in low pH soils, you might need to take that into consideration when planning a fertilizer program. Different fertilizers also have different effects on soil pH so you may be able to match your soil pH to your fertilizer for best results. Ammonium and urea forms of nitrogen are acidic and nitrate forms are basic. Fertilizers may have a mix of types so check the label.

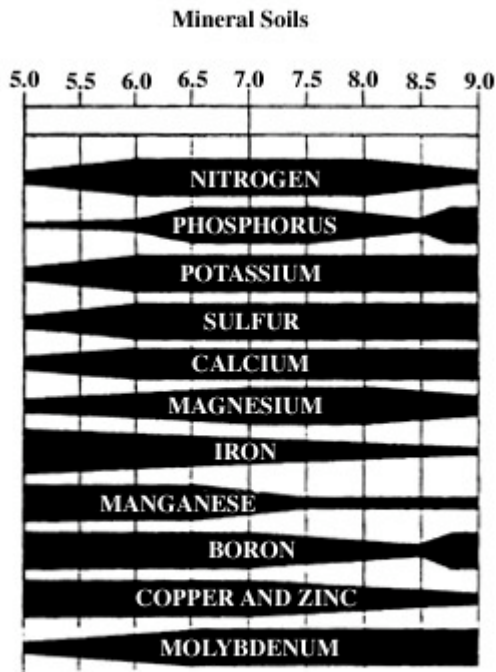


Figure 1. The relative availability of elements essential to plant growth at different pH levels for mineral soils.

The pH and alkalinity of your water source can also affect your production. For example, alkaline water will reduce soil pH over time. Few field grown conifers grown in NY are irrigated, so this may not be a concern but for those grown in pot production, irrigation water may need to be acidified to maintain the low soil pH desired.

The pH and alkalinity of your water can also affect how your pesticide applications work. In some cases, high alkalinity causes the active ingredient to break down. Water pH over 7 can affect the efficacy of glyphosate (Roundup), paraquat (Gramoxone), bentazon (Basagran), clethodim (Envoy), sethoxydim (Poast), and 2,4-D (many products). (http://oregonstate.edu/dept/nursery-weeds/feature_articles/spray_tank/spray_tank.htm). The following table lists the optimum water pH of certain insecticides and miticides and comments from the Cornell Pest Management Guide for Commercial Production and Maintenance of Trees and Shrubs.

Common Name	Optimal Water pH	Tree and Shrub Guidelines
Abamectin	6.0 to 7.0	
Acephate	5.5 to 6.5	
Acetamiprid	5.0 to 9.0	
Azadirachtin	5.5 to 6.5	Do not mix with alkaline materials, buffer water to pH 3-7

Bifenazate	6.5 to 9.0	Do not mix with alkaline materials, buffer water to pH 7
Bifenthrin	5.0 to 9.0	
Carbaryl		Buffer water to pH 7
Chlorpyrifos	5.0 to 9.0	
Dimethoate		Do not mix with alkaline materials
Dinotefuran	5.0 to 8.0	
Etoxazole	6.0 to 8.0	
Fenpyroximate	5.5 to 6.5	
Flonicamid	4.0 to 6.0	
Fluvalinate	5.0 to 7.0	
Imidacloprid	5.0 to 7.0	
Insecticidal soap*	6.5 to 7.5	
Methidathion		Do not mix with alkaline materials
Neem oil**	5.0 to 7.0	
Phosmet		Do not mix with alkaline materials, buffer water to below pH 6
Pymetrozine	7.0 to 9.0	
Spinosad	6.5 to 7.5	

* Active Ingredient=Potassium salts of fatty acids

** Active Ingredient=Clarified hydrophobic extract of neem oil

Adapted from Ray Cloyd, GrowerTalks,
<http://www.ballpublishing.com/growertalks/viewarticle.aspx?articleid=17155>

How do you know what your soil or water pH and alkalinity are? There are many reasonably priced(\$30 to \$250) pH meters available When selecting a pH meter, look for an accuracy of ± 0.1 pH

unit and a range of 1 to 14. Be sure to purchase solutions for calibrating your pH meter and remember to calibrate it before use. Test kits are available for measuring water alkalinity. Look for one that measures in a range of 0 to 8 meq/L (0 to 400 ppm alkalinity expressed as CaCO_3). If you don't want to do it yourself, most labs that do complete water and soil analysis include both pH and alkalinity in their reports, which cost between \$30 and \$60.