GROWERTALKS

Features

1/15/2009

Controlling Your Growing Media PH

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Imagine driving your car or truck down the road not knowing what speed you were travelling because your speedometer was broken. Would you be going fast enough to get where you wanted to go in the time you allotted? Or would you be going too fast and get a ticket or run off the road? Driving with a broken speedometer is like growing plants without measuring media pH. Bad things happen when the media pH is too low or too high for what the crop prefers. By the time the plant shows you symptoms, it could be too late to correct the problem. Have you ever tried using the excuse that your speedometer is broken when pulled over by a cop for speeding? Doesn't work, does it? Neither does growing by the seat of your pants.

Media pH controls nutrient availability to the plant. This is the primary reason we need to measure media pH. Table 1 shows what nutrients are tied up or become excessive when media pH is out of line in a peat-based growing mix. If you don't test the growing media on a regular basis, then you're waiting for the plants to show the problems. Not all crops show the same symptoms, nor do all plants of the same crop show the symptoms at the same time. Differences in weather conditions, greenhouses and watering techniques can influence when and how many plants will show problems. Stunted growth, loss of roots, increased root rots and death of plants can result.

Symptoms and susceptible crops

Generally, when media pH in a peat-based growing mix is maintained between 5.5 and 6.5, nutrients are readily available to all plants. However, some crops are more sensitive to pH below 6.0. These include geraniums (especially seed types), African marigolds, lisianthus, pentas, and New Guinea impatiens. Symptoms of low media pH will generally show on the lower leaves and roots. Bronzing, speckling and marginal necrosis on lower leaves indicate micronutrient toxicities, such as iron and manganese. NG impatiens may show curled-down leaves and stunting, similar to growth regulator overdose. Poor root development may also occur due to calcium deficiency if media pH is sufficiently low enough.

Table 1. Nutrient availability changes with pH in peat-based media

PH RANGE →	5.5	6.5
	EXCESS	**EXCESS**
	Manganese (Mn)	Calcium (Ca)
	Iron (Fe)	Nitrogen (N)
	Boron (B)	
	Copper (Cu)	
	Zinc (Zn)	
	Sodium (Na)	
	Ammonium (NH_4)	
	READILY AVAILABLE	
	DEFICIENT	**DEFICIENT**
	Calcium (Ca)	Iron (Fe)
	Magnesium (Mg)	Manganese (Mn)
	Phosphorus (P)	Boron (B)
	Potassium (K)	Copper (Cu)
	Sulphur (S)	Zinc (Zn)
	Molybdenum (Mo)	Phosphorus (P)
		Magnesium (Mg)
	5.5	6.5
PH RANGE →		

On the other hand, when media pH gets to 6.5 or higher, there are a number of crops that will show symptoms. These crops include vinca, pansy, petunia, primula, snaps, dianthus, calibrachoa, diascia and nemesia. Symptoms will generally show on the upper leaves first and may include interveinal chlorosis, stunted growth, tip abortion, strapped or twisted new leaves, and even root rots. Always check the roots first! If root rot is evident, then correct that problem before lowering the media pH. Thielaviopsis root rot likes a higher media pH and can become more of a problem when plants are grown under stress. Snaps tend to get pythium root rot very easily when grown cool and wet, along with high media pH. The interveinal chlorosis can be due to iron deficiency, while the tip abortion can be boron deficiency. Note that these micronutrients are tied up at high media pH.

Factors controlling media pH

Before we talk about how to correct media pH, you need to understand the four main factors controlling media pH in a peat-based mix. These include, in order of importance, 1) alkalinity of the water, 2) lime in the media, 3) type of fertilizer used, and 4) the plant's roots. Failure to measure and control any of these factors will make it difficult to keep media pH in the optimum range.

First, alkalinity of the water is like lime in the water. The more alkalinity, the more the water will raise the media pH over time. Water pH doesn't directly affect media pH; alkalinity does. Every time you water, whether with feed or clear water, you're adding lime to the media. Desired ranges include 60 to 80 ppm for plugs and propagation, and 80 to 120 ppm for finished bedding plants and pot crops. Have a lab test your water right from the hose every six months, as alkalinity can change with dry or rainy seasons. If the alkalinity is too high, you can use sulfuric acid with an acid-head injector to neutralize the amount needed. If alkalinity is too low, there is no buffering effect of the water. This means that any chemical you add to water with very low alkalinity will react in the soil solution much more quickly than you may want. If alkalinity levels are so high that they cannot be controlled with sulfuric acid safely, then reverse osmosis, pond water or city water may be the best alternatives.

Second, peat moss in the growing mix is very acidic, so it's necessary to add limestone to help bring media pH up into the desired range. Not all lime is the same. Hydrated lime (calcium hydroxide) is quick acting but short lived. Calcitic lime (calcium carbonate) is slower to act and lasts longer. Dolomitic lime (calcium + magnesium carbonates) takes even longer to act but lasts the longest. Gypsum (calcium sulfate) is not considered a lime but is a good source of slow-release calcium. Size of lime particles will also influence speed of action. The larger the particles or mesh, the slower the lime activates but the longer it lasts. Irrigation frequency will also affect lime activation. The more frequently you water, the faster the lime activates and runs out. Always test every new load of growing mix you buy. You can test it dry out of the bag and after filling trays or pots and watering for a week. Generally, lime in the media will activate within the first two weeks of watering. If your growing mix is 5.4 dry but changes to 6.2 after two weeks, you could have problems with too much lime in the mix.

Table 2. Common Commercial Fertilizers[a]

Fertilizer	NH_4^+ (%)	Potential Acidity[c]	Potential Basicity[d]	Ca[e] (%)	Mg[e] (%)
21-7-7	100	1560	—	—	
9-45-15	100	940	—	—	
20-20-20	69	583	—	—	
20-10-20	40	422	—	—	
21-5-20 (Excel)	40	418	—	—	
15-15-15 *	52	261	—	—	
15-16-17 *	30	165	—	—	
20-0-20	25	40	5	—	
17-5-17	24	0	0	3	1
17-0-17	20		75	4	2
15-5-15 (Excel)	22		141	5	2
13-2-13	11		200	6	3
14-0-14	8		220	6	3
15-0-15	13		420	11	—

a List of some commercially available fertilizers used for plugs and bedding plants. Not all formulations are the same from every company. Check the label!

b NH_4^+ (%) is the total nitrogen percentage that is in the ammonium plus urea forms; the remaining nitrogen is nitrate.

c Pounds of calcium carbonate limestone required to neutralize the acidity caused by using 1 ton of the specified fertilizer.

d Application of 1 ton of the specified fertilizer is equivalent to applying this many pounds of calcium carbonate limestone.

e Only where % Ca or % Mg were 1% or greater.

* Contains sodium nitrate (nitrate of soda), which adds unwanted sodium to plugs.

Third, your choice of fertilizer will influence media pH. In general, the higher the percentage of ammoniacal nitrogen (NH4) in the fertilizer, the more acidic the reaction and the faster the media pH will decrease. Fertilizers higher in nitrate nitrogen (NO3) and calcium (Ca) will tend to raise the media pH. When using 13-2-13 or 15-0-15, expect the media pH to increase. Avoid making choices of fertilizer just based on their effects on media pH, however. You need to know what that fertilizer will do for plant growth, as well. Fertilizers from the top half of Table 2 will promote more shoot growth, bigger leaves and more stretch. Fertilizers from the bottom half of Table 2 will promote more root growth, smaller leaves and more controlled and toned shoot growth.

Finally, the plant roots themselves can affect the media pH. This effect really only occurs when the container is getting more rootbound. For instance, vinca roots will push up the media pH, causing problems with plugs when delays in transplanting occur. Be aware of high media pH on vinca plug trays holding past normal transplant date, as root decline can easily occur after transplanting. Geranium roots tend to lower the media pH, causing problems with micronutrient toxicities on lower leaves.

Correcting media pH problems

Testing sensitive crops on a weekly basis is a must to prevent any problems from getting too far out of hand. I suggest testing a few high-pH sensitive crops, such as vinca, petunia, snaps, pansy and calibrachoa, weekly and keeping pH below than 6.5. For low-pH sensitive crops, such as geraniums, African marigolds, lisianthus, pentas and New Guinea impatiens, test weekly and keep media pH 6.0 or higher. Back up any in-house testing with lab results every month. Keep track of weekly pH readings to determine trends.

When the media pH starts too low for some crops, you can raise it quickly using several techniques. First, use a basic fertilizer such as 13-2-13 or 15-0-15. However, this technique won't work well when the plants are still small with few roots through the growing container, or when the weather is cool and wet. If you use acid injection to control alkalinity in the water, you can turn it off for a week or two, letting the higher levels of alkalinity (or lime in the water) raise the media pH with each watering. Finally, you can use a drench of either liquid or flowable lime or potassium bicarbonate to quickly raise pH within a couple of days. Liquid lime should be used at 4 qts. per 100 gal. water with agitation in stock tank and applied with hose and breaker, not through drip lines. Make sure to rinse off plants right away, as liquid lime will coat them in white. With potassium bicarbonate, purchase technical grade to avoid contaminates, and use at 2 lbs. per 100 gal. water. Potassium bicarbonate dissolves completely but should still be rinsed off leaves and can be used through drip lines and on flood floors. You should use a basic fertilizer such as 13-2-13 shortly after using potassium bicarbonate to help keep enough calcium and magnesium available for the plants. Do not apply to completely dry soil, and apply a volume sufficient for at least 30% leaching. Most growers don't apply enough volume and therefore don't see enough change in media pH. Generally, you should see an increase of a half unit in pH within three days. If you don't, then reapply liquid lime at the same rate. Avoid reapplying potassium bicarbonate, as you'll overload the media with potassium and cause high-salt problems.

The above methods are short-term fixes for low media pH, where you have to do something quick to save the crop. But you need to find out why you have low pH problems and fix them long term. First, make sure your

acid injector isn't putting out too much acid and lowering alkalinity too far. Target ranges are 60 to 80 ppm for plugs and propagation, and 80 to 120 ppm for finished bedding plants and pot crops. Second, look into your choice of fertilizers. Too much ammoniacal nitrogen will drop media pH too much, as will a number of controlled-release fertilizers. Test different lime rates for your type of growing media, and work with your media supplier to find the best rate. If you mix your own media, then you can use a higher lime rate for those low-pH sensitive crops, switching over to your regular lime rate for everything else. Or you can just plan on using a liquid lime drench shortly after seeding or transplanting.

When the media pH climbs too high (6.5 or higher), you have several options for lowering the pH quickly. First, if you are using acid injection for alkalinity control already, turn up the acid to get water pH to 4.5. This will lower alkalinity levels to zero and quickly help drop the soil solution around the roots. Only use this technique as long as it takes to get pH back in line, and then readjust your acid injection. Second, you can use an acid fertilizer, such as 21-7-7, to drop pH quickly and green up plants. This type of fertilizer is three times as acid as 20-10-20. Be ready for more shoot growth, however. And remember that fertilizers high in ammoniacal nitrogen should not be used when soil temperatures are lower than 60F (16C), as ammonium toxicity can occur. Plants that are still small with few roots won't react as much as older plants. Finally, you can use a drench of iron, either with iron chelate or iron sulfate. Best chelates to use are either iron-EDDHA (Sprint 138) or iron-DTPA (Sprint 330) at 4 to 5 oz. per 100 gal. water. Apply to moderately moist soil with sufficient volume to see leaching, and rinse off foliage right after application. Iron chelates don't lower media pH but will make iron more available to plants over time, thus greening up the leaves. Iron sulfate will do both but is more difficult to use than iron chelates. Use fresh iron sulfate (less than six months open) at 1 to 2 lbs. per 100 gal. as a thorough drench, and rinse off plants immediately! Dry fresh iron sulfate should be a bluish color and clear in solution if initial water pH is less than 7.0. If it's exposed to air, it will oxidize, turning yellowish brown and not dissolving in water very well, thereby losing a lot of its potential to lower media pH. Unless the crop really needs more iron, however, I always recommend using 21-7-7 fertilizer for best results, assuming you have growth control already.

The above are short-term fixes for high media pH and may have to be reapplied every other week or so. You should look into why you have high media pH and work on preventing the problem. First, if you don't know what your alkalinity levels are, find out. Set up an acid injection system to bring alkalinity levels down to the proper range consistently. This is the best long-term fix you can do. Next, look at your choices of fertilizers and plan on using some acid fertilizers periodically. Or you can use 15-5-15 or 17-5-17 fertilizers, as they're pretty much neutral on media pH. Finally, work with your media supplier to decrease the amount of lime used or change types or mesh of lime to keep from going too high on media pH over time.

Remember, media pH is like the speedometer on your car: You want to keep it within the desired range, but you need to know what that range is first. Test sensitive crops weekly, start with properly mixed growing media, test your water and control alkalinity, and remember what your choice of fertilizer will do for both plant growth and media pH. And keep the above tools handy in case of emergency!

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