Five Keys to Quality Spring Plants

Achieving perfection is not as hard as you think, as long as you control these factors.

By Roger Styer

With spring season nearly upon us (or in full swing for those growers far south and west), everyone is getting extremely busy taking care of all those crops in the greenhouse. Days are full of transplanting, watering, moving crops, spraying and other needed duties; however, sometimes growers can forget about some key factors in growing quality plants.

In my visits with growers around the country, I continually stress the need to be vigilant with the following key areas:

- media pH control
- choice of fertilizers
- moisture management
- growth regulator applications
- disease and insect control

These five key cultural aspects will determine whether or not you have quality plants going out the door each and every week. Focusing on them is an ongoing process. An early spring can make things go much easier because plants are not being held, and some crops offer more assurance of success simply because they are easier to grow than other crops; however, growers are required to produce more vegetative annuals, which are harder to grow and control. So, here is what you need to know about the five keys to producing quality spring plants.

MEDIA PH CONTROL

Media pH concerns us only because it affects the availability of nutrients to plants. Generally, all nutrients are available in a peat-based media with a pH range of 5.5-6.5 (see Figure 1, right). If the media pH is less than 5.5, micronutrients become excessively available, while calcium becomes less available. If the media pH is greater than 6.5, micronutrients become less available, while calcium becomes excessively available.

Four primary factors influence media pH. The first is alkalinity in the water. Think of alkalinity as lime in the water. The higher the alkalinity, the more you raise media pH each time you water. Keep alkalinity levels at 80-120 ppm for spring plants. Levels higher than this will require acid injection to control. If your water source is less than 60 ppm you should consider injecting fertilizers containing calcium and magnesium (at a rate of 25 ppm) on a constant basis.

The second factor is the lime already in the media. Peat-based media are amended with lime to overcome the acidity of the peat moss. Determine the initial media pH, and then monitor the pH for two weeks without adding fertilizer. If the media pH rises too quickly you need to look at how much lime is being added. You want your media pH to start around 5.5 and go no higher than 6.0 during the first two weeks. Also, be aware that media pH will tend to climb faster as the weather gets warmer and you water more often.

The type of fertilizer used for particular crops is the third factor in media pH control. Some fertilizers, such as 20-20-20 and 20-10-20, are very acidic and will lower media pH. Other fertilizers, such as 13-2-13, 14-0-14 and 15-0-15, are basic and will raise media pH. Figure 2, page 54, shows the potential acidity or basicity of some commercially available fertilizer formulations.

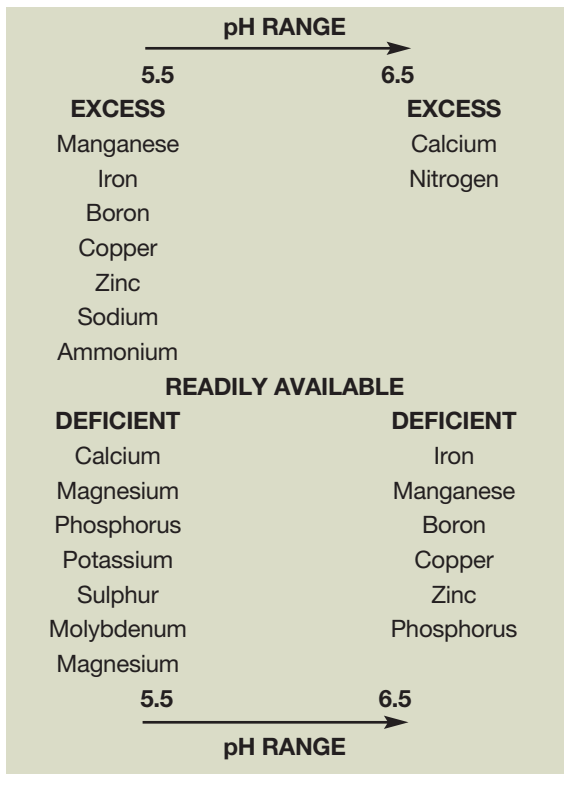
Some crops are sensitive to high media pH (greater than 6.5) and will show symptoms such as upper yellow leaves, tip abortion and stunting. Sensitive crops include petunia, calibrachoa, vinca, pansy, snapdragon, dianthus and primula.

Likewise, other crops are sensitive to low media pH (less than 6.0), displaying symptoms of bronzing, speckling, margin burn, spotting and necrosis of lower leaves. These crops include seed and zonal geraniums, African marigolds, penta, lisianthus and New Guinea impatiens.

CHOICE OF FERTILIZERS

As mentioned previously, some fertilizers are acidic, some are basic and some are neutral or close to neutral (17-5-17 or 15-5-15). The more acidic the fertilizer, the more ammonium nitrogen and phosphorus it contains (see Figure 2, page 54). These nutrients promote rapid top growth, big green leaves and crop stretch. They do not help the root systems or provide tone to the crop. The more basic the fertilizer the more nitrate nitrogen, calcium and magnesium it ➧

Figure 1. How nutrient availability changes with pH in peat-based media.



contains. These nutrients will favor the root system, provide more tone to the crops and help with earlier flowering.

Many growers are discovering that a neutral or near-neutral fertilizer provides a degree of growth control (thus reducing the need for chemical growth regulators), while still providing enough nitrogen for good leaf growth. Both 15-5-15 and 17-5-17 contain the proper levels of calcium and magnesium, and neither fertilizer will dramatically change media pH. During lower light and cooler conditions use fertilizers such as 13-2-13 to control growth even more, but realize that this fertilizer will tend to raise media pH.

MOISTURE MANAGEMENT

The key to growing quality spring plants is moisture management, which involves more than just when and how much to water. Also important is the size of the container being watered, the humidity levels in the greenhouse and the rate of leaf dry. During cloudy, cool, rainy weather watering should be done very judiciously, if at all. Try to water plants just before this type of weather is anticipated. Once the sun returns make sure plants are sufficiently watered. This means watering through the container. I see growers who overcompensate for their fear of stretch or disease by watering very lightly but more frequently. This very often results in chronically dry media at the bottom of the container, which leads to poor root development. Likewise, frequent waterings actually promote diseases such as Rhizoctonia and Botrytis by creating more humidity in the plant canopy.

Figure 2. Some commonly available commercial fertilizers. Not all formulations are the same from every company. Check the label.

Fertilizer	% NH_4 [a]	Potential Acidity[b]	Potential Basicity[c]	% Ca	% Mg
21-7-7	100	1,560	N/A	N/A	N/A
9-45-15	100	940	N/A	N/A	N/A
20-20-20	69	583	N/A	N/A	N/A
20-10-20	40	422	N/A	N/A	N/A
21-5-20 (Excel)	40	418	N/A	N/A	N/A
15-15-15 *	52	261	N/A	N/A	N/A
15-16-17 *	30	165	N/A	N/A	N/A
20-0-20	25	40	N/A	5	N/A
17-5-17	24	N/A	N/A	3	1
17-0-17	20	N/A	75	4	2
15-5-15 (Excel)	22	N/A	141	5	2
13-2-13	11	N/A	200	6	3
14-0-14	8	N/A	220	6	3
15-0-15	13	N/A	420	11	N/A

[a]Percent NH_4 is the total nitrogen percentage that is in the ammonium plus urea forms; the remaining nitrogen is nitrate.
[b]Pounds of calcium carbonate limestone required to neutralize the acidity caused by using 1 ton of the specified fertilizer.
[c]Application of 1 ton of the specified fertilizer is equivalent to applying this many pounds of calcium carbonate limestone.
**Contains sodium nitrate (nitrate of soda), which adds unwanted sodium to plugs.*

Humidity control and air movement are very important in controlling plant growth and diseases. Make sure you set a dehumidification cycle both at the end of the day and first thing in the morning to vent damp air out of your greenhouse. Air movement caused by proper venting or HAF fans will help dry off leaves going into the night. This will help control many diseases, especially Botrytis.

GROWTH REGULATOR APPLICATIONS

Even if growers do the best job possible with fertilizer, moisture management and environmental control, some spring plants will still require height control with chemical growth regulators.

In the North you can start out with B-Nine on many crops, Cycocel or A-Rest on some, and Bonzi or Sumagic on just a few. In the South you can start out with B-Nine on a few crops, Cycocel or A-Rest on some, and Bonzi or Sumagic on many crops. Once the weather warms up B-Nine will not control growth enough. Move up to A-Rest, Bonzi or Sumagic for continued control (see Figure 3, right, for Bonzi and Sumagic spray rates). The tank mix of B-Nine plus Cycocel can provide good control on many crops. Start with 1,000 ppm of each and increase as needed to the maximum rates of 1,500 ppm Cycocel and 2,500 ppm B-Nine.

Florel can be used on some crops for increased branching, disbudding and growth control (see Figure 4, page 58). Use Florel early in the crop cycle, avoid stress on the plant when spraying, keep water pH less than 5.0 in the spray tank and spray thoroughly. Keep track of how long it takes the plant to reflower. Plan on 6-7 weeks for geraniums, petunia, calibrachoa, torenia, New Guinea impatiens, double impatiens and fuchsia.

B-Nine, Cycocel and Florel take a long time to get into the plant. Keep leaves wet for 3-4 hours to get the majority of the chemical inside. All are absorbed through the leaves and stems. A-Rest, Bonzi and Sumagic get into the plant within 30 minutes. A-Rest is absorbed through the leaves, stems and roots, whereas

Figure 3. Classification of some bedding plants by optimum rate range for Bonzi sprays.

	OPTIMUM RATE RANGE		
GROUP	**BONZI PPM**	**SUMAGIC PPM**	**CROPS**
High	30-60	15-30	African marigold, petunia, penta, salvia, snapdragon
Medium	15-30	5-15	Celosia, coleus, dahlia, French marigold, verbena, most other crops
Low	5-15	1-3	Geranium, impatiens, pansy, vinca
Don't Use			Begonias

***Note:** Growers in the North should start with the low end of rate or lower, especially during cooler weather. Under retractable-roof greenhouse conditions (high light), you can use the low end of rate even if it is hot. (Courtesy of Jim Barrett, University of Florida)*

Bonzi and Sumagic get in through the stems and roots. For effective spray coverage of Bonzi and Sumagic, you must get stem coverage without a lot of dripping into the media.

A-Rest, Bonzi and Sumagic have strong activity in the soil through root uptake. You can use these chemicals as a sprench or drench for longer control without delaying flowering. Figure 5, page 74, shows some drench rates for Bonzi on vegetative annuals in the Mid-south. Cut the rate in half for the North, and double the rate for the far South.

It is important to ensure that drench applications uniformly saturate the media. Water the plants one day ahead of your planned drench time. The volume of drench solution applied will vary with the container. Use 4 oz. on 6-inch pots and 15 oz. on 10-inch baskets. The volume used is proportional to the container and should result in a 10-percent run-through. Pine bark will reduce the activity. Increase the rate 25-100 percent, depending on the amount of pine bark and the level of decomposition. Drenches can be applied by hand, drip or Chem-doser (Dramm Corp.). For bedding flats and 4-inch pots apply the drench as you would feed the crop, but make sure media is already moist. Apply the drench when plants are up to saleable size and starting to flower. Properly done, drenches will provide 2-3 weeks holding, but you must make sure they grow out of the drench after that time period. Do your own trials to determine the ppm needed, when to apply and what application method to use. Leave some plants untreated to check how much control you are getting.

DISEASE AND INSECT CONTROL

An effective disease control program focuses on moisture management, air movement, spacing, scouting, weather conditions and the right chemical for the right disease. As mentioned previously, many diseases are promoted by overwatering, high humidity, poor air movement and wet leaves at night. Try to dehumidify the greenhouse first thing in the morning and again at the end of day. Improve air movement and spacing. Water plants well and only when they need watering.

Watch your local weather report to anticipate conditions favorable for diseases. Spray susceptible crops right before the weather hits to get the most protection. Drench root rot-susceptible crops such as vinca, geranium and snaps right before plugs are transplanted and

continued on page 74

Figure 4. Crops responsive to Florel.

Bacopa
Bidens
Brachycome
Calibrachoa
Coleus, vegetative types
Diascia
Evolvulus
Fuchsia
Geraniums, ivy and zonal
Helichrysum
Herbs
Ipomoea, sweet potato vine
Lamium
Lantana
Lavandula
Lobelia, vegetative types
Lysimachia
Nemesia
Osteospermum
Petunia, vegetative types
Plectranthus
Purslane
Salvia, vegetative types
Scaevola
Snapdragons, vegetative types
Verbena, vegetative types
Vinca vine

crop cultivation

continued from page 58

again three weeks after transplanting. Keep crops clean of dead and dying leaves, and remove trash and dead plants from the greenhouse. When spraying fungicides make sure to get under leaves for best control, or use systemic or locally systemic chemicals. Learn how to recognize symptoms of the most common diseases and viruses, and send in any suspicious samples to your favorite disease lab.

Knowing what disease you have will determine what fungicide to spray. Rotate chemicals for root rots, Botrytis, downy and powdery mildews, and other common diseases. Figure 6, right lists some recommended fungicides for different diseases.

The keys to insect control are sticky cards, scouting, understanding susceptible crops, selecting and rotating proper chemicals, and applying chemicals thoroughly. Use yellow sticky cards placed 2 inches above the crop; blue cards can be used for thrips. Place one sticky card per 1,000 sq.ft. of growing area. I like to place cards in susceptible crops (such as impatiens, gerbera or begonia for thrips), or very near vents or walkways. Check the cards every couple of days, and replace weekly. Use the cards to pinpoint hot spots, and spray accordingly.

Chemicals should be selected for the type of insect you want to control (see Figure 6, right). Use the same chemical 2-3 times in a row, then rotate to a different mode of action to control the potential for resistance. If using insect growth regulators only apply once or twice to a crop. Thorough coverage is needed for many insects. Utilize ULV, autofog or total release canisters when possible. Try to use two different methods of applying chemicals to improve your coverage. Not all chemicals can be used with all application methods.

These five keys can help you to produce quality spring plants and improve your profits. Do your own trials to find out what works, and document your crop culture so you can repeat your successes. Failure to adhere to these key

Figure 5. Crop listing for growth regulators (Mid-South).

Crop — Vegetative Annuals	Bonzi Drench Code[a]	Other Growth Regulators[b]
Angelonia	D3-4	Pinch
Argyranthemum	D2-3	Pinch or Florel
Bacopa	D2-3	Florel
Begonia, tuberous	None	B-Nine + Cycocel, A-Rest spray
Brachycome	D2-3	N/A
Bracteantha	D2-3	Florel
Calibrachoa, Million Bells	D3-4	Florel
Carnation	D2-3	Florel
Cobbity daisy	D2-3	Florel
Coleus, sun	D4	Florel, B-Nine + Cycocel
Cuphea	None	B-Nine + Cycocel
Dahlia	D3-4	N/A
Dianthus	D2-3	Florel
Diascia	D2-3	Florel
Evolvulus	D3	Florel
Fuchsia	D1	Florel
Geranium, all	D1-low	B-Nine + Cycocel, Florel
Helichrysum	D3-4	Florel
Impatiens, double	D3-4	Florel
Impatiens, New Guinea	D1-low	B-Nine + Cycocel
Ipomea, sweet potato vine	D3-4	Florel
Lantana	D3-4	Florel
Lysimachia	D2-3	Florel
Nemesia	D2-3	Florel
Osteospermum	D2-3	Pinch or Florel
Petunia, cascading	D3-4	Florel
Petunia, Double Wave	D4-5	Bonzi sprays early, Florel
Plectranthus	D2-3	Florel
Portulaca, Yubi	D2-3	Florel
Salvia	D2-3	Florel
Scaevola	D2-3	Florel
Snapdragon, trailing	D2-3	Florel
Torenia	D2-3	Pinch
Verbena	D3-4	Florel
Vinca vine	None	Florel every two weeks

[a]Bonzi drench codes: D1=½-1 ppm, D2=1-2 ppm, D3=2-3 ppm, D4=3-5 ppm, D5=5-8 ppm
[b]Other growth regulator spray and drench rates: B-Nine spray=2,500-5,000 ppm, A-Rest spray=3-10 ppm, A-Rest drench=Add 1-5 ppm to Bonzi drench rate, B-Nine + Cycocel=1,000-2,500 + 350-1,000 ppm, Florel spray=250-500 ppm, Bonzi spray=10-20 ppm

Figure 6. Recocmmended fungicides and pesticides.

DISEASE	CHEMICAL
Bacterial leafspots	Camelot, Rhapsody, Kocide, Junction, Phyton 27
Botrytis/Sclerotinia	Chipco 26019 (26GT), Daconil, Exotherm Termil, Decree, Heritage, Compass, Medallion, Phyton 27
Downy mildew	Aliette, Alude, Heritage, Compass, Stature
Fusarium	Heritage, Compass, Daconil, Medallion (Leafspots), Terraguard
Fungal leafspots	
Alternaria/Curvularia	Chipco 26019 (26GT), Daconil, Dithane, Manzate, Protect T/O, Heritage, Compass, Medallion, Stature, Zyban, Spectro, Junction, Systhane, Terraguard
Anthracnose	Heritage, Compass, Dithane, Junction, Kocide, Systhane, Phyton 27, Camelot, Zyban
Cercospora	Heritage, Compass, Rhapsody, Junction, Spectro, Zyban, Phyton 27, Medallion, Strike, Systhane, Terraguard
Colletotrichum	Heritage, Compass
Mycosphaerella	Daconil, Spectro
Myrothecium	Heritage, Compass, Medallion
Phomopsis	Kocide, Junction
Septoria	Heritage, Compass, Junction, Spectro, Zyban, Medallion
Powdery mildew	Pipron (eradicant only), Milstop, Heritage, Compass, Rhapsody, Rubigan, Banner MAXX, Phyton 27, Triact, Strike, Systhane, Terraguard
Pythium/Phytophthora	Aliette, Alude, Heritage, Compass (Aerial Phytophthora), Stature (Aerial Phytophthora), Subdue MAXX, Truban, Terrazole
Rhizoctonia/Sclerotium	Cleary's 3336, Fungo, OHP 6672, Spectro, Contrast, Daconil, Heritage, Medallion, Terraclor (not with seedlings)
Rusts	Banner MAXX, Cleary's 3336, Dithane, Manzate, Protect T/O, Fungo, Heritage, Compass, OHP 6672, Strike, Systhane, Terraguard, Triact
Scab	Heritage, Compass, Dithane, Manzate, Protect T/O, Stature, Systhane, Terraguard
Thielaviopsis	Cleary's 3336, Fungo, OHP 6672, Terraguard, Medallion

INSECT	CHEMICAL
Aphids	DuraGuard, Duraplex, Endeavor, Marathon, Marathon II, Tri-Star, Flagship, Orthene + Talstar or Tame, Thiodan
Caterpillars (worms)	Conserve, Decathlon, Dipel, Thiodan
Fungus gnats/ shoreflies (adults)	Attain TR, Talstar, Decathlon, Duraplex, PT1100 Pyrethrum, PT1300 Orthene, Thiodan
Fungus gnats/ shoreflies (larvae)	Adept (not labeled for poinsettias), Azatin, Ornazin, Citation, Distance, DuraGuard (not on plugs), Enstar II, Marathon, Tri-Star, Flagship, Gnatrol (fungus gnats only), Nemasys (fungus gnats only), *Hypoaspis miles* (fungus gnats only), Atheta beetles (fungus gnats and shoreflies)
Leafminers	Avid, Conserve, Citation
Mealybugs/scale	Azatin, Ornazin (mealybugs), Talus, Distance, Decathlon, DuraGuard, Duraplex, Enstar II, Horticultural oil, M-Pede, Marathon II, Tri-Star, Flagship, Triact 70
Mites	Akari, Sanmite, Pylon, Avid, Tetrasan, Floramite, Hexygon, Ovation
Thrips	Avid + Talstar, Tame, Azatin, Ornazin, BotaniGard, Naturalis-O, Conserve, Mesurol, Orthene + Talstar or Tame, Pedestal, Thiodan
Whiteflies	BotaniGard, Naturalis-O, Talus, Distance, Endeavor, Marathon, Marathon II, Tri-Star, Flagship, Orthene + Talstar or Tame, Pedestal, Thiodan

Note: Not all pesticides listed here are labeled for all ornamental crops. Before applying to the whole crop test-spray a few plants, and look for phytotoxicity after a few days. Rules for chemical usage vary between different states. Always read and follow label directions, and use proper precautions in applying chemicals. The information presented here does not constitute an endorsement of particular chemicals over others, only what seems to work most effectively. There are many other chemicals labeled for the above diseases and insects which can also be used.

areas can result in disaster and lost sales. GPN

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Late Drench for Bedding Plants

It is common for bedding plants produced in flats to become overgrown before they can be shipped. It is also common for them to become stretched and overgrown as they sit at retail outlets. Plants grown in flats are spaced close together, and when the leaves begin to overlap, they are prone to stretch as the plants compete for light. The same situation can occur with bedding plants in pots spaced close together. This problem is aggravated later in the season when sales slow and temperatures increase.

A solution to this problem is a late Bonzi drench. Spray applications of any growth regulator after plants are budded or flowering may delay or stop flowering. Drench applications at appropriate concentrations should not affect flowering, but does stop stretching. The optimum Bonzi rate is one that will hold the bedding plants for about two to three weeks. This will allow the plants to grow normally after consumers plant them in beds.

A late Bonzi drench can be applied easily by hand with a hose using techniques similar to applying water-soluble fertilizers. Using an injector will ensure that the final Bonzi concentration in the irrigation water is at the desired drench rate. Several companies make portable injectors that are effective for applying a Bonzi drench to small areas.

An example of the correct calculations for a Bonzi drench is as follows: If you want to drench Bonzi at 0.5 ppm, which is 0.016 fl. oz. (0.5 ml) per gallon of water applied to the plants, and the ratio of the injector you are using is 1:100, you should put 100 times as much Bonzi in the stock tank (bucket). In this example, the correct amount is 1.6 fl. oz. (50 ml) of Bonzi per gallon in the stock tank. Users should read the Bonzi label and follow all prescribed precautions for applying Bonzi by chemigation.

When applying a Bonzi drench by hand using a water hose, uniformity of the application is important. Variations in the volume of solution applied will result in variations in