POUR THRU TESTING OF CONTAINER MEDIA

We will use meters to test properties of container media: pH and EC.

pH

- a measure of how acidic or basic a solution is due to the presence of H^+ ions
- this is an inherent property of the container media substrates; and is also influenced by water and fertilizer that is added during the experiment
- the pH affects the ability of fertilizer elements to dissolve in water, which influences their ability to be absorbed by roots

Electrical Conductivity (EC) units are dS/m (note: 1 ds/m = 1 mmhos/cm = 1000 µS/cm)

- a measure of the amount of soluble salts in a solution
- soluble salts may come from the substrate itself, fertilizer elements, and as salts that are impurities in water or fertilizers
- the EC meter measures the passage of electrical current through a solution - the more salts that are present in water, the easier it will be for an electric current to pass through the solution

It is useful for growers to measure the EC of their container media to estimate if enough fertilizer salts are being provided; similarly they will measure the pH to determine if the nutrients present in the media are in a form easily available to be absorbed by roots

The PourThru Method for Testing Container Media

Steps for the PourThru method

1. water containers to saturation (so that a few drops of water come out of the bottom of the container) with the normal irrigation water they have been receiving
2. after container has drained for one hour, place a saucer under the container

3. pour enough distilled (DI) water on the surface of the container to get 50 mL (1.5 fluid ounces) of leachate to come out of the bottom of the container (Table 1)
4. collect leachate for pH and EC testing
5. calibrate pH and EC meters
6. measure pH and EC of samples

Table 1. Amount of distilled water to apply to the container surface to obtain 50 mL of solution extract for the PourThru method

Container Size	Water to Add	
	mL	Fluid ounces
4-6 inch	75	2.5
6.5 inch azalea	100	3.5
1 quart	75	2.5
4 quart	150	5.0
12 quart	350	12.0
Flats (per pack)	50	2.0

INTERPRETING TEST DATA

EC (Electrical Conductivity)

The values that you measure for EC will depend on the method you use for testing the container media. EC guidelines for several horticulture crops are presented in the table on page 6.

Problems with Low EC

A low EC means that your plants are not getting enough fertilizer salts. Symptoms can include stunted plant growth or leaf discoloration due to lack of nutrients. Nitrogen deficiency (yellowing of lower leaves) often appears first.

Problems with High EC

Excess salts can accumulate when: you are applying more fertilizer than the plant requires; the container media has a high initial salt level; leaching during irrigation is insufficient; or your water source contains naturally high levels of salts. Excess salts can cause tissue death. Symptoms often appear first on the lower leaves and appear as yellowing (chlorosis) or browning (necrosis) that begins at the edges of the leaves and spreads inward. High salts can cause root tips to die back; and plants may show wilting even though the medium is still moist. High salt levels have been shown to increase the incidence of *Pythium* root rot. Solutions to high salts include leaching with clear water, then cutting back on the fertilizer rate if that was what caused salts to accumulate in the first place.

pH

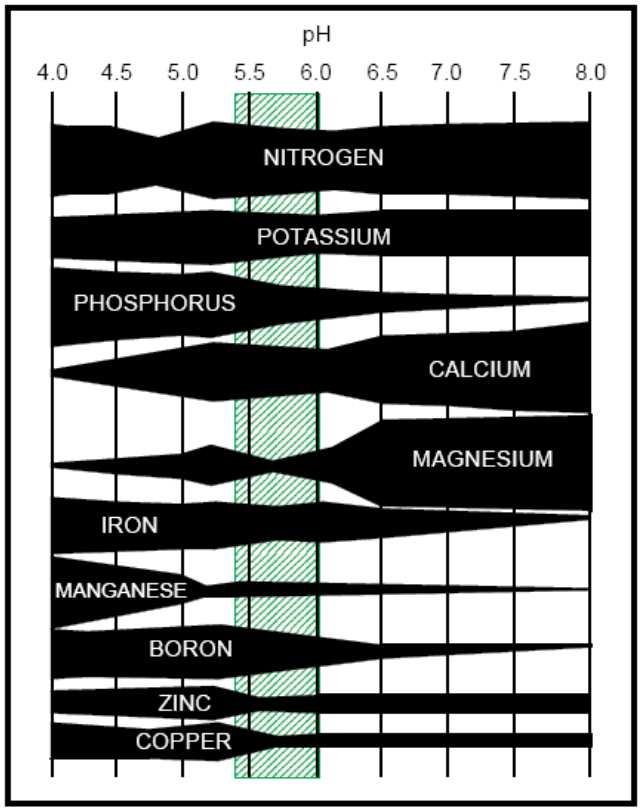
pH affects the ability of nutrients to dissolve in water (solubility). Solubility is important because roots can only take up nutrients that are dissolved in solution and cannot take up the solid form of the nutrient.

Problems with Low pH

In container media, the micronutrients iron, manganese, zinc, and boron are highly soluble at low pH (pH 5.0-6.0). Therefore, at low pH these nutrients are available and readily taken up by roots. If pH is too low, typically below 5.0 for most plants, the nutrients become so soluble that they may be taken up at harmful or toxic concentrations. A classic symptom of this is iron toxicity which appears as leaf bronzing and chlorosis which appear first on lower leaves. Certain plants that are especially efficient at taking up iron, such as seed and zonal geraniums and marigolds, can exhibit iron toxicity when pH is below 6.0.

Problems with High pH

At high media pH the low solubility of phosphorus, iron, manganese, zinc, and boron (see figure below) makes these nutrients less available to be taken up by roots and so deficiency symptoms can occur. Certain plants are less efficient at absorbing micronutrients (especially iron and manganese). These plants require a slightly lower pH to be able to absorb enough of these nutrients. A classic example of this is iron deficiency is petunia. Affected plants show yellowing between the veins on the upper leaves. Often there is enough iron provided in the fertilizer/container media, but the pH is too high for roots to absorb it.

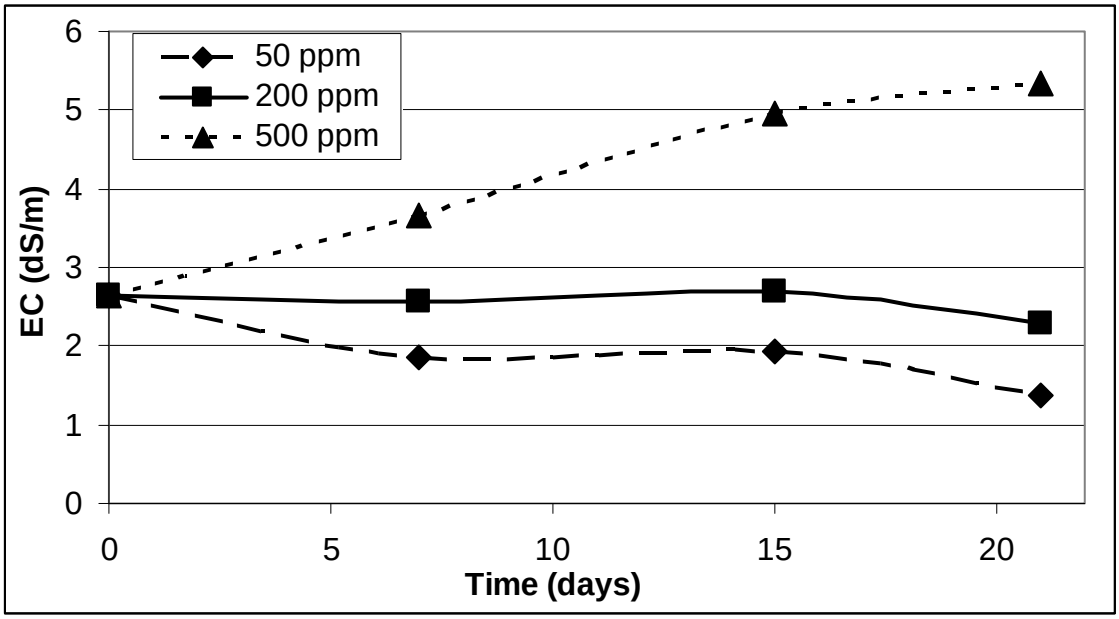


pH Guidelines

Based on the problems described above, excessively high and excessively low pH should be avoided. For many plants growing in container media a pH of 5.5-6.5 typically allows the various mineral nutrients to be absorbed at adequate levels; and not at levels too high that toxicity can result. Because certain plants are more efficient at absorbing iron and other micronutrients. For this reason we can further break down the recommended pH based on the specific plant that is being studied (see page 7).

LONG-TERM MONITORING

Sampling container media for pH and EC is most effective when samples are taken periodically during crop production as opposed to measuring at only 1 time point. This allows you to look for trends. If pH or EC begin to creep outside of the preferred range, then action can be taken to bring these under control. In the example below, bedding plants were grown with a complete fertilizer mix (21-5-20 $N:K_2O:P_2O_5$) at 3 different levels of nitrogen.



The general EC guideline for bedding plants is 1.0-2.6 dS/m.

Salts levels are accumulating too high in the 500 ppm treatment. And salt levels are declining and may eventually be below range for the 50 ppm treatment. (Data from: Neil Mattson)

EC Guidelines for PourThru and Saturated Media Extract (SME) Methods

Table 2. The relative nutrient requirements of actively growing greenhouse crops, with EC ranges for both the SME and PourThru methods. Use this classification system and the examples provided in Figure 3 for the PourThru method to determine the suggested target EC ranges for the entire crop production cycle.

No Additional Fertilizer Required

Amaryllis
Crocus
Narcissus

Light
(SME EC of 0.76 to 2.0 mS/cm)
(PourThru EC of 1.0 to 2.6 mS/cm)

Aconitum
African Violet
Ageratum
Anemone
Anigozanthos
Asclepias
Aster
Astilbe
Azalea
Balsam
Begonia (fibrous)
Begonia (Hiemalis)
Begonia (Rex)
Begonia (Tuberous)
Caladium
Calceolaria
Calla Lily
Celosia
Cineraria
Coleus
Cosmos
Cuttings (during rooting)
Cyclamen
Freesia
Geranium (seed)
Gerbera
Gloxinia
Impatiens
Marigold
New Guinea Impatiens
Orchids
Pansy
Plugs
Primula
Salvia
Streptocarpus
Snapdragon
Zinnia

Medium
(SME EC of 1.5 to 3.0 mS/cm)
(PourThru EC of 2.0 to 3.5 mS/cm)

Alstroemeria
Alyssum
Bougainvillea
Calendula
Campanula
Cactus, Christmas
Carnation
Cauliflower
Centaurea
Cleome
Clerodendrum
Crossandra
Dahlia
Dianthus
Dusty Miller
Exacum
Geranium (cutting)
Hibiscus
Hydrangea
Jerusalem Cherry
Kalanchoe
Larkspur
Lily, Asiatic & Oriental
Lily, Easter
Lobelia
Morning Glory
Onion
Ornamental Kale
Ornamental Pepper
Oxalis
Pepper
Petunia
Phlox
Platycodon
Portulaca
Ranunculus
Rose
Sunflower (potted)
Tomato
Verbena

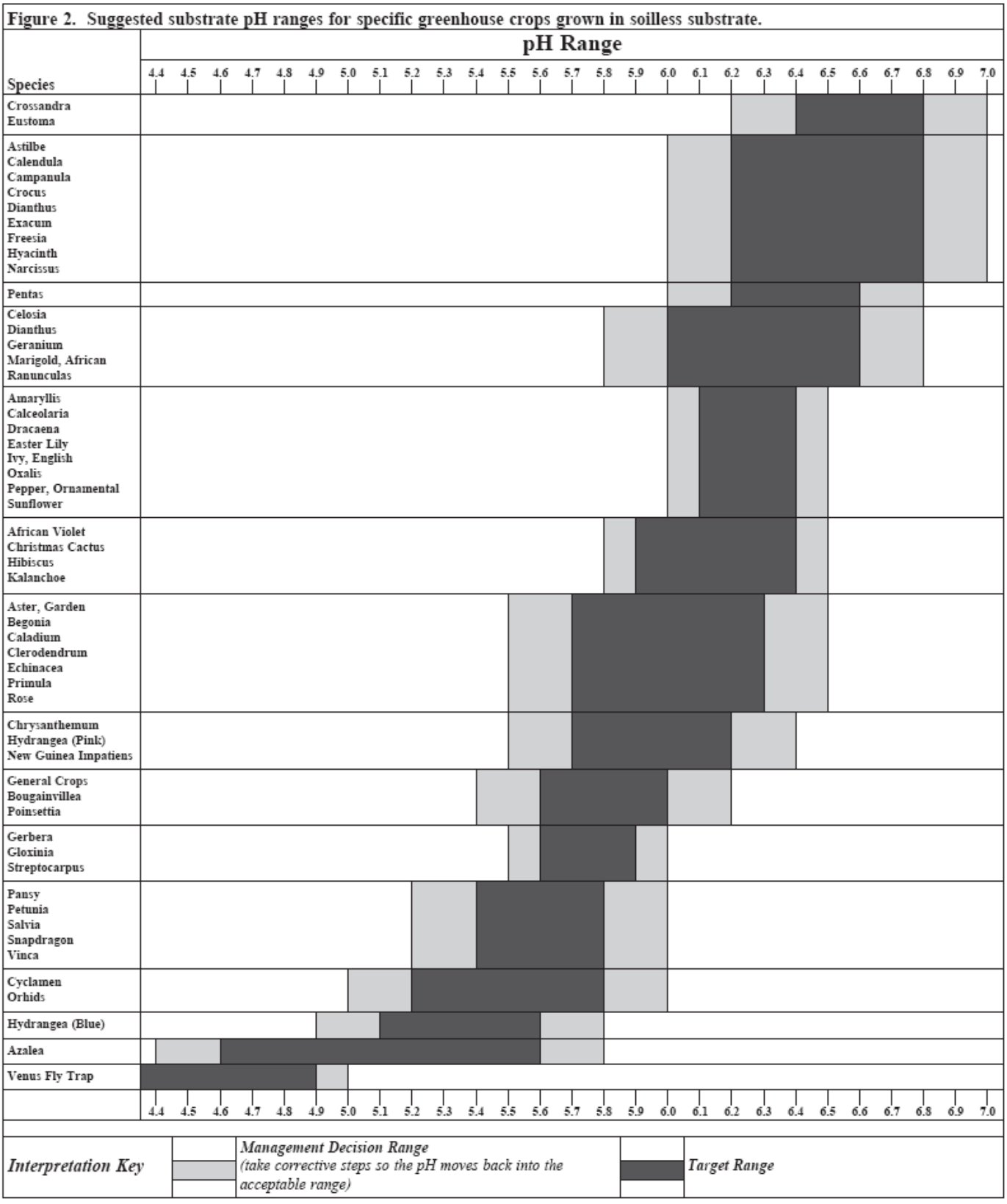
Heavy
(SME EC of 2.0 to 3.5 mS/cm)
(Pourthru EC of 2.6 to 4.6 mS/cm)

Chrysanthemum
Poinsettia

Adapted from:
Bunt, A.C. 1988. Media and mixes for container-grown plants. Unwin Hyman Press. pp. 309.
Devitt, D.A. and R.L. Morris. 1987. Morphological response of flowering annuals to salinity. J. Amer. Soc. Hort. Sci. 112:951-955.
Dole, J. and H. Wilkins. 1999. Floriculture principles and species. Prentice Hall.
Hofstra, G. and R. Wukasch. 1987. Are you pickling your pansies? Greenhouse Grower. Sept: 14-17.
Nelson, P.V. 1996. Macronutrient fertilizer programs, p. 141-170. In: D.W. Reed. Water, media, and nutrition for greenhouse crops. Ball Publ., Batavia, IL.
Wilkeraon, D.C. Soilless growing media and pH. Texas Greenhouse Management Handbook. p.30-34, 45-47.

Source for chart on this page and the next page: Monitoring and Managing pH and EC Using the Pour Thru Extraction Method. North Carolina State University. Online: http://www.pourthruinfo.com/

Suggested pH ranges for Specific Greenhouse Crops in Container Medium



References: prepared by Neil Mattson, Assistant Professor and Floriculture Extension Specialist, Cornell University; v. 11/13/08
PourThru information from NCSU available online at: http://www.pourthruinfo.com