Back to the Future: Insights Learned Over Many Years – Relevant Then, Now and for the Future©

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1. Roots come first. Watch any seed germinate, from anywhere on the planet and it always sends down a root before producing a shoot. As the root system goes, so goes the plant (11, 12, 16, 31, 42, 46, 48).

2. Plants run on energy, just like everything else! Focus on energy production improves growth, health and all other aspects (3,9,10,17,46).

3. Energy produced is not uniformly distributed. The priority of distribution: flowers, fruits, leaves, stems and, finally roots. Any reduction in energy affects roots first (3,9,10,17,46).

4. Energy produced in plant tops, mostly stays there. Energy produced by mid section leaves, mostly goes to flowers, fruits and new growth. Most energy going to the root system is produced in leaves on lower branches. Increase root branching, increases nutrient and water absorption and energy production (9,10,17,23,39,46).

5. If in doubt, ask the plant! Try 3 to 7 treatments, use uniform liners, replicate 8 to 10 times and watch. In nearly all cases, plants will tell you their preference. If no clear answer, change treatments or rates and try again. A computer is not needed to do valid research (34,36,46)..

6. Your first loss is your best loss! If you purchase 500 liners, only pot up the good ones. You will be saving money by tossing the marginal ones. If in doubt, throw it out! At any stage, culling marginal plants is the wise thing to do (12, 13,33,42,46).

7. When your pH meter breaks, save your money --- do not replace it! Any pH reflects only proportion of acids vs. bases and tells you nothing about "what acids" or "what bases"; pH is a common scapegoat (19,24,44,45,46,52).

8. I often see the "optimum" pH, but plants show problems. On the other hand, if total nutrition is near optimum, pH will be in the "optimum" range (19,40,46,50).

9. More is not better: especially as it relates to micronutrients. It is NOT how much available iron, but how much iron relative to manganese, relative to boron, relative to copper, etc. All six micronutrients have an associated inner-dependency (13,37,38,41,46).

10. If you have what appears to be micronutrient deficiencies or toxicities, go back to item 5 - and compare plant growth using your current micronutrient source vs. my original Micromax®. For example, there are four major sources of iron sulfate, but two work poorly, one fair and one very well. The one that works best also costs more. The same is true for the other micronutrient elements. Cheap is - well, cheap (37,38,41,46).

11. When I did a factorial study with the six micronutrient elements (729 treatments), all four test species grew best with the same combination. Forget specialty fertilizers and specialty mixes: get your growth medium, nutrition and drainage right - and you can grow anything in one simple mix (46).

12. Just because a plant is native to a location, does not mean that is where it grows best. Ecologically it may be optimal or suboptimal for that environment. Two striking examples; *Pinus radiata* which is native to California, grows far better in Southern Australia and New Zealand. Likewise, *Melaleuca leucadendron*, native to Australia, grows far better in South Florida (16,25,31,46).

13. Work with the plant. Minimize dictating to the plant. Always add Micromax® @3/4 lb. and 18-6-12 Osmocote (the original 8 to 9 month release, single coating) @ 6 lb. /cu. yd. to the propagation mix for seeds or cuttings. Do not make the plant wait until **you** decide to provide nutrition (1,2,7,29,30,38,46).

14. Chemistry of irrigation water is the most commonly overlooked factor affecting plant nutrition. Most common problems: excess sodium, high bicarbonates and high calcium. Calcium is the bully in container growth media. Avoid excess calcium (4,8,22,24,29,30,37,44,45,46,52).

15. Drainable pore space and Darcy's Law - (summarized): Water will move from a coarse texture to a fine texture readily. Water will not move from a fine texture to a coarse texture until near saturation. Any mix in a container is fine textured relative to the drain holes. Percent drainable pore space should be about 20% (5,27,35,46,49).

16. Pots with vertical slots are just pots that loose water faster. Sidewall openings provide no benefits unless roots are guided into the openings for air-pruning (35,43,46).

17. The 4 in. rule. When actively growing root tips are killed by dehydration (air-pruning) or root tip trapping, much branching along the root axis will occur --- back about 4 in. Place a plant started in an 18 cell RootMaker® tray which is about 4 in. square into a container 10 to 12 in. in diameter, such as a RootMaker® 3 or 5 gallon container. Roots grow out, are air-pruned at the sidewall and branch profusely back to the face of the original ball. The resulting fibrous root system exploits the full volume of the container for maximum absorption of water and nutrients (6,28,46).

18. Killing root tips with toxic levels of copper or zinc or --- creates more complications than benefits. Let that one die! (46).

19. Any more than 30% shade and you are using shade as a crutch. Light drives the energy production system. (See #4) (14,15,20,21,26,46).

- Know what you know. Know what you do not know. Do not get the two mixed up!

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