Is Green Good Enough?

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The accepted standard for evaluating plants has been color. If a plant had "good green color," it was assumed to be healthy and as good as one could expect. Basic nursery practices reflect this assumption. Unless some yellowing or lightening of the green color occurred, little, if any attention was given to refinements in nutrition. As one nurseryman said, "My goal is to keep the plants green."

Research over the years has convinced me we can do much more to enhance plant health. Following is a compilation of some of these experiments and my comments on what they mean for the future.

In 1975 I compared several rates of each of several micronutrient fertilizers with supplements of specific elements. Midway through the growing season a heavy grasshopper population developed. I considered spraying for the grasshoppers; however, we had no appropriate insecticide on hand, and by the time the pesticide arrived, I noticed an interesting trend. The grasshoppers were not feeding on the Burford holly plants indiscriminately. Leaf damage was slight to the chlorotic control that had no micronutrients in the mix and to the two treatments that were much higher in micronutrients and were producing the best growth. The greatest feeding occurred on plants from treatments that resulted in moderate growth and an acceptable green color.

The grasshopper feeding was left unchecked, and the contrast continued to increase. Entomologists were skeptical until they visited the study, which was set up in six randomized blocks.

Burford holly was also used in a study with a number of rates and sources of N, P, and K at the same time. This study was located approximately 40 ft away but on the same container bed. Soil mix, watering, light intensity, and other conditions were the same for both studies. The feeding of the grasshoppers on this study was independent of the N-P-K treatments. However, this study was closer to a large landscape planting of euonymus, which was a favorite target for grasshoppers. To determine if location played a role, three replications of each of the two studies were carefully marked and switched, block for block, the grasshoppers continued to avoid certain micronutrient treatments and to feed selectively on others (unpublished data).

Following this experience I intensified my study of micronutrient nutrition and the influence on plant health and natural resistance. One of the products of that research is Micromax micronutrient fertilizer (Grace-Sierra), first introduced in 1980 (Whitcomb et al., 1981). Various studies followed and continued to show that the natural resistance in plants could be enhanced beyond the visual criterion of being good green color.

By 1988 many improvements in N-P-K slow-release fertilizers and calcium and magnesium nutrition had occurred. Since changes in these five major elements might influence micronutrients, it was decided to investigate further the interactions and rates of six micronutrients. Years of experimental data were reviewed to determine the preferred level for iron, manganese, copper, boron, zinc and molyb-

denum. Treatments in the study were the preferred level, one-half the preferred level, and twice the preferred level. The study was conducted as a 1/9 fraction of a 3^6 factorial (81 treatments) with six replications per species and four species for a total of 1933 plants. The test species were Fashion azalea, dwarf pittosporum, Blue Pacific shore juniper, and Wilson's yellow daylily.

The study was conducted at a container nursery in central Florida in full sun using overhead sprinkler irrigation and trade 1-gal containers (160 cubic in.). The irrigation water was analyzed for chemical content and the level of dolomite adjusted accordingly (Whitcomb, 1988; Whitcomb, 1989).

An experimental 16-5-11 Osmocote formulation was used for the N-P-K. Studies conducted on this same site in 1987 showed this outperformed other formulations and competitive products. Two pounds dolomite and 12 lb Osmocote per cubic yard were added to the soil mix for all treatments. For accuracy, chemicals for each container were weighed out in advance in small zip-lock plastic bags.

The procedure in setting up the study was as follows: Containers were filled with a mix of 3 pine bark : 1 peat : 1 sand (by volume) with no chemical additives. A container of mix was emptied into a 3-gal bucket, the contents of the bag were added and thoroughly mixed by hand, then all returned to the container and labeled. Uniform liners of each species were selected and planted. The study was in place on 24 February 1988. Watering, weeding, and herbicide applications were done as a regular part of the nursery operations. No insecticides or fungicides were used. The entire study was evaluated in June and September, and three of the four species were evaluated in November. In addition, the staff of the nursery monitored plant growth and watched for any outbreak of pests or disease. None occurred.

None of the plants of any of the species showed any chlorosis or discoloration to suggest nutrient stress. Since each plant had at least one-half of what previous studies indicated as the preferred level of each micronutrient element, the total absence of chlorosis was not particularly surprising. What was surprising was the differences in plant growth and quality. The most striking result occurred with Fashion azaleas. The size of the tops of the plants varied moderately when evaluated in November. A difference in the number of flower buds and size of the flower buds could be observed, but no attempt was made to count buds at this time. The decision was made to leave the azaleas and try to evaluate flowering the following February or March.

Wilson's yellow daylily was included at the nursery owner's request. He said that on average single fans planted in one-gal containers multiplied to about three fans at the end of the growing season. In November three of the treatments in the study averaged 7.8 shoots for the six replications, whereas the poorest treatment averaged only 2.1.

Fresh top weights of Blue Pacific shore juniper and dwarf pittosporum were significantly different among the various treatments. Weight of junipers ranged from 95 to 128 g; dwarf pittosporum from 72 to 139 g. However, plant quality varied much more. The juniper ranged from a visual grade of 6.4 to 9.8 on a 1 to 10 scale where 10 is best. The pittosporum ranged from 5.1 to 9.1. The plants were never pruned; however, the number of branches per plant were widely different. For example, the best treatment for the juniper had 66 branches per plant while the poorest treatment hand only 14. This shows that natural branching can be enhanced, which would minimize the need for pruning.

On 25 February 1989, the azaleas were in full bloom. Differences in numbers of flowers were easy to see. It was found that these differences were consistent among the replications. The plants with the fewest blooms per plants averaged only 24 while three treatments averaged 171, 167, and 166. In these three treatments the foliage was masked by the flowers. When the data were analyzed and compared, the same three treatments were best for all four species.

Several observations seem relevant:

1) All 1944 plants were dark green throughout the study, yet substantial differences in plant responses were observed.

2) When N, P, K, Ca, and Mg are in the preferred range, response to micronutrients can be striking.

3) All four species grew most favorably with the same treatments. This suggests that these diverse species have common nutritional requirements and that special container mixes and nutrition programs are not necessary for each species.

4) There were no disease or insect problems on any of the species.

5) Green is not good enough.

The results of this and other studies indicate that plant growth and health can be enhanced beyond just good green color when evaluated by criteria other than color. In this case the criteria were daylily multiplication, azalea flower number, and juniper and holly branching and top weight.

In addition to direct plant improvement, increased branching could reduce the amount of pruning needed. Less pruning would reduce production costs as well as reduce the number of entrance opportunities for pathogens. One of the current challenges is to find a way to evaluate plant health without relying on color.

Consider ranking plant health on a scale from one to 10 where 10 is the best, and below 3 the plant is not a good green.

Unfortunately, at the present time there is no way to tell a plant that would rate 4 from one that would rate 6 or 9. Such a tool is needed if we are to further advance plant health and productivity and minimize labor and our dependence on pesticides.

Green is clearly not good enough. Taking plant nutrition and health to a higher level requires careful evaluation of as many factors as possible that affect plant growth. All of these must be synchronized if plant growth and vigor are to be enhanced. The answers are complex and difficult to sort out, but clearly they are valuable benefits to be had in the future as a result of complex studies nutritional refinements.

LITERATURE CITED

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