

Pushing Plants for Maximum Versus Optimum Growth: Beware of Imbalances

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Balanced Nutrition. “Balanced nutrition” is the key to good plant health and vigor. Growers and researchers have tried for years to quantify and identify exactly what it takes to maximize plant growth. Not everyone agrees on the proper quantity or source of plant nutrients that is best for maximizing plant growth, but everyone does seem to agree that a proper balance of all plant nutrients is essential.

When trying to maximize growth, especially with high N soluble fertilizers, K frequently becomes deficient. When “pushing” with N and K, Ca and/or Mg, and S deficiencies usually occur. It is extremely difficult to keep **all** nutrients in balance when trying to maximize growth.

Problems with Trying to Maximize Growth. Fortunately, plants can and do survive on less than perfectly balanced nutrition. My purpose today is to alert you to problems associated with trying to maximize growth and to suggest guidelines for optimum nutrition. Problems caused by imbalances/deficiencies are not worth the little extra growth the grower wished to get. Unfortunately, there are many hidden deficiencies/imbalances that are not easily recognized, but often become painfully obvious at times of stress. Less plant tolerance to stresses caused by moisture excesses, nutrient deficiencies, high and low temperatures, insects, and diseases are often related to nutrient imbalances. Guidelines for nutrient ranges based on the saturated media extract (SME) Method are given in Table 1. I have found that plant growth is better with balanced nutrition levels even at low fertility levels, than when N, K, Ca, and Mg are out of balance. Table 2 shows a desirable nutrient balance which I have found to be an excellent guide.

Table 1. Suggested nutrient ranges for organic media analyzed by the saturated media extract (SME) method.

Analysis	Category				
	Low	Acceptable	Optimum	High	Very high
pH	-5.0	5.0-5.5	5.5-5.9	5.9-6.4	6.4+
Sol-salts, mmhos	-0.5	0.5-1.5	1.5-2.5	2.5-3.5	3.5+
Nitrate-N ppm	-35	35-85	85-105	105-220	220+
Phosphorous ppm	-2	2-6	6-10	10-16	16+
Potassium ppm	-35	35-85	85-105	105-220	220+
Calcium ppm	-20	20-60	60-85	85+	-
Magnesium ppm	-15	15-40	40-60	60+	-

Guidelines for Optimum Nutrition. "Optimum growth" is difficult to define, but some of the features are good uniform color and vigor with no excessive succulence and a balance of shoot and root growth. Before using a new, untried growing medium, first test for available nutrients, pH, and soluble salts. Also, media samples should be taken regularly (at least monthly) to maintain a balance of nutrients at levels within accepted guidelines.

The SME method is ideal for testing media before and after planting, but for growers who do their own sampling and testing, the Virginia Tech Extraction Method (VTEM) is much simpler to use after planting. Guidelines for optimum levels using the VTEM must be established by each user. I have found comparisons between growers to be useless unless they use the same medium, the same fertilizer source and rate, the same water source, and they are in the same climatic region.

For all crops with good established root systems, adjust the nutrient levels to the optimum range (Table 1), prior to planting. Use the lower end of the range for salt sensitive crops.

Table 2. Desirable nutrient balance in saturated medium extract.

Nutrient	Percent of total soluble salt
Nitrate N	8-10
Ammonium N	less than 3
Potassium	8-10
Calcium	6-8
Magnesium	4-6
Sodium	less than 6
Chloride	less than 6

Testing Lime Requirements for pH Adjustment. A good way to test lime requirements for pH adjustment is to mix a small batch (0.1 yd³) of medium using the lime rate you think is correct. Moisten the medium and place in a large plastic bag for 2 weeks, then check the pH. Be sure to use finely ground limestone with a minimum of 50% passing through a 100 mesh sieve. Avoid media with too high a pH as it is more difficult to lower pH than to raise it.

Conclusion. Briefly summarizing, potassium is the nutrient most often limiting in container fertility programs and in my experiences this has been caused by improper N-P-K ratios (a 3-1-2 ratio is my preference) and excessive nitrogen applications used to maximize growth. Also, S, Ca, and Mg deficiencies often are associated with attempts to maximize growth. My suggestion is to find a good slow-release fertilizer source that will give you optimum nutrient levels for an entire growing season and avoid trying to maximize growth.