NUTRIENT RECOMMENDATIONS BY CROP

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AGRONOMIC CROP NUTRIENT RECOMMENDATIONS BASED ON SOIL TESTS AND YIELD GOALS

The Maryland Cooperative Extension Soil Testing Laboratory analyzed soil samples and generating plant nutrient application recommendations from 1954 until its closing in 2003. Over the years, fertility recommendations have been updated as improved laboratory methodologies have been developed, as cropping systems and crop genetics have improved, and as our understanding of the relationship between laboratory soil test results and crop yields has advanced.

Philosophy of Soil Testing

There are several philosophies that may be embraced when developing crop nutrient recommendations. Some of these different approaches involve attempting to Abalance@ the levels of nutrients in the soil, while others aim at maintaining a constant soil fertility level. One unwavering component of Maryland's plant nutrient recommendation program has been a continuous commitment to the sufficiency level philosophy of soil testing. The sufficiency level concept is based on long-term calibrations of soil tests with field yield response data that reveal soil test levels above which no yield response to applied nutrients is observed. At soil test levels below the sufficiency level, field calibration data determine the quantity of applied nutrient that is necessary to obtain maximum yield under local growing conditions.

Crop Yield Goals

Crop yield potential, or yield goal, also changed over the years as a reflection of the cumulative advances in crop production practices and management expertise. Practical, realistic yield goals are now included as a vital component in the development of agronomic crop nutrient recommendations based on soil testing. Realistic crop yield goals will differ among farms, among fields within a farm, and with different levels of management of a given field. A yield goal should be a realistic target yield that is achievable given favorable growing conditions.

Soil Testing Procedures

The Maryland Cooperative Extension Soil Testing Laboratory employed the Mehlich 1 (e.g. double-acid) procedure for determining the levels of soil test phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), copper (Cu), and zinc (Zn). A hot water soil extract is used for boron (B) determination and an acidic monocalcium phosphate solution is used to extract sulfate sulfur (SO_4-S). All nitrogen recommendations are based on crop nitrogen requirements and yield goals.

Soil Test Interpretive Categories

The Maryland Cooperative Extension Soil Testing Laboratory generated numerical values, or soil test results, that describe the relative availability of a given nutrient to the crop and the expected crop response to application of that nutrient to the soil. The soil test results were grouped into four interpretive categories, "Low," "Medium," "Optimum" and "Excessive."

Low: The nutrient concentration in the soil is inadequate for optimum growth of most crops and will very likely limit plant growth and yield. There is a high probability of a favorable economic response to additions of the nutrient.

Medium: The nutrient concentration in the soil may or may not be adequate for optimum growth of most crops. Plant growth and yield may be

limited by the availability of this nutrient. There is a low to moderate probability of a favorable economic response to additions of the nutrient. ***Optimum:*** The nutrient concentration in the soil is adequate for optimum growth of most crops. There is a very low probability of a favorable economic response to additions of the nutrient. ***Excessive:*** The nutrient concentration in the soil is more than adequate for optimum growth of most crops. Nutrient additions most likely will be unprofitable and may have undesirable effects on growth of some crops.

Fertility Index Values

The actual numerical soil test values are products of laboratory procedures that determine the concentrations of extractable plant nutrients in a measured volume of soil (mg nutrient per dm^3 soil). Thus, soil-test values are merely arbitrary index numbers and not measures of the actual quantity of plant available nutrients present in a soil.

Historically, these numerical soil test values have been converted to units of "pounds per acre" of soil test nutrient or as a concentration of the nutrient in the soil, such as parts per million (pap).

An alternative method for expressing the relative level of plant available nutrients measured by soil testing uses "fertility index values" (FIV). Fertility index values comprise a continuous relative scale that is calculated from the concentration of extractable nutrients measured in the laboratory, where the highest concentration within the "optimum" range is set equal to a fertility index value of 100 (FIV = 100). Thus, the FIV ranges for the four soil test interpretive categories are: low = 0 to 25; medium = 26 to 50; optimum = 51 to 100; and excessive = >100.

The numerical values generated by different soil testing procedures employed by different soil testing laboratories can be easily converted to the FIV scale for relative comparison. For more information on converting soil test results from one laboratory to another, see "Converting among Soil Test Analyses Frequently Used in Maryland," SFM-4, which is available from your Maryland Cooperative Extension county office, or online at http://anmp.umd.edu.

Agronomic Plant Nutrient Recommendations

Agronomic plant nutrient recommendations based on soil tests and yield goals for the major agronomic crops grown in Maryland are presented in Tables 1 through 10. These recommendations are based on the cumulative knowledge derived from decades of soil fertility research. Where ranges of applied nutrients are indicated, the amount of plant nutrient required depends on the exact numerical soil test value within the soil test category.