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Adjusting Fertilizer Recommendations for Ground-Level and Raised-Bed Gardens

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Gardens for fruit, vegetable and ornamental plants have historically been planted at ground level in native soils. They were typically managed like field crops, with the target of managing the top six inches of soil. In recent years, however, raised-bed gardens have gained popularity due to the many advantages they offer, including reduced tillage, their suitability for small areas and the growers' ability to manufacture soil conditions.

While nutrient requirements do not differ between ground and raised-bed gardens, additional management and planning is necessary to maintain soil nutrients in raised beds. This article addresses the adjustment of fertilizer recommendations for both gardening systems.

Nutrient Management Contrasts

A garden soil has inherent and dynamic physical and chemical properties that will influence its management requirements and productivity levels. Inherent properties are developed over time and are typically inherited from parent materials (e.g. soil texture, soil depth and some nutrient concentrations). Dynamic properties, on the other hand, are impacted by management practices, such as soil structure, water holding capacity and some nutrient concentrations. This contrasts with raised bed gardens, as the physical and chemical properties of these "soils" are dependent on the components used to create them. Soils in many raised garden beds are made using a mix of native soil and soilless media such as peat moss, compost, pine bark or perlite. Because of this, management strategies have a much greater impact on the productivity of these soils.

There are 16 essential nutrients that plants require for growth and production and are typically found in varying concentrations in native soils. Often, raised bed gardens use "manufactured soils" or soilless substrates that may also contain these nutrients, although the levels largely depend on the composition and inputs. One similarity between the two gardening styles is that macronutrients — nitrogen (N), phosphorus (P) and potassium

(K) — are used in the greatest amounts by plants and will require more precise management. Managing nutrient inputs to maintain fertility is important to prevent nutrient surplus or deficiencies that could negatively impact production.

When dropping off soil samples at a soil analysis lab, it is important to denote if you have a soilless media or heavily amended soil, as the analysis process for these will differ from those used for native soils.

UADA laboratories can analyze native soils, heavily amended soils and soilless media, but only routine analysis for native soils is free to Arkansas taxpayers. Additionally, fertilizer recommendations can be given for soils and soilless media, but they will require different interpretations. Testing soil or growing media is important for monitoring the levels of available nutrients and provides recommendations necessary to improve or maintain those levels. However, a thorough understanding of the application of fertilizer recommendations is necessary to properly manage fertilizer inputs for growth and production.

Adjusting Fertilizer Recommendations

Due to the historical production of plants over a given area of native soil, fertilizer recommendations are given for two-dimensional areas such as "per 1,000 square feet" or "per acre." While most garden fertilizer recommendations provided by the UADA Marianna soil testing laboratory are expressed in terms of "per 1,000 square feet," it is important to understand how to convert between the two unit-areas if needed.

To convert from pounds per acre to pounds per 1,000 square feet:

$$\left(\frac{\text{lb per acre}}{43.56}\right)=\text{lb per 1000 sq. ft.}$$

To convert from pounds per 1,000 square feet to pounds per acre:

$$(\text{lb per 1000 sq. ft.} \times 43.56) = \text{lb per acre}$$

Understanding Area and Volume

Traditional ground-level garden nutrient management is based on a given area of soil to a depth of six inches, known as a furrow slice. Most soil management decisions will affect the soil to this depth and typically contain the greatest volume of roots. Soil management in raised-bed gardens, on the other hand, will influence the full depth of the growing media. Due to this, fertilizer recommendations need to be adjusted for the change in volume between ground level and raised bed garden. So, the next step in adjusting fertilizer recommendations is knowing the area or volume the fertilizers will be applied to.

Calculating the Area of a Garden:

For any garden, whether ground-level or raised-bed, you must determine the area of the garden that will receive fertilizer. To do this, measure the length of the area from six inches before the first plant extending to six inches past the last plant to be fertilized. If you are fertilizing the entire garden, measure from end to end of the garden. Next, measure the width of the area to be fertilized, starting in the middle of the furrow before the first row to the middle of the furrow after the last row to be fertilized, or edge to edge if the whole garden will receive fertilizer. Round all measurements to the nearest 0.5 foot and use the equation below to calculate the total area to be fertilized:

$$\text{Length (ft.)} \times \text{Width (ft.)} = \text{Area (sq. ft.)}$$

For ground level gardens, this calculated value will be used to calculate the amount of nutrients needed to fertilize the area:

$$\text{lb per 1000 sq. ft.} \times \left(\frac{\text{Area (sq ft.)}}{1000}\right)=\text{lb per Area}$$

Calculating the Volume of a Raised Garden Beds:

A 1,000-square-foot ground-level garden would presumably have a native soil depth of six inches, providing a total volume of 500 cubic feet. Since raised bed gardens are typically deeper than six inches, recommendations need to be adjusted for the difference in volume. To determine volume, measure the area of the raised-bed garden or area to be

fertilized, as previously described, and multiply it by the soil/growing media depth measured in feet. It is important to note that mulching layers should not be included in this depth, since mulch is not intended to support plant root growth.

Area (sq.ft.) × Depth (ft) = Volume (cu. ft.)

The volume of the raised-bed garden can be used to adjust the fertilizer recommendations to the change in managed depth.

$$\text{lb per 1000 sq. ft.} \times \frac{\text{Volume (cu. ft.)}}{500} = \text{lb per Fertilized Rasied Bed Area}$$

Figure 1. How to measure the length, width, and depth of a raised bed garden area. Dotted lines represent the areas to be measured.

Converting Volumetric Units

If fertilizer label recommendations are followed, and the recommendation is provided per cubic yard, this value can also be adjusted to ensure the label recommendations are accurately applied. To do this, follow the previously described steps to determine the volume of the fertilized area and convert this to cubic yards with the understanding that 1 cubic yard equals 27 cubic feet. If a ground-level garden is being fertilized the area, in square feet, should be multiplied by 0.5 to represent a six-inch soil depth.

Volume (cu.ft.) ÷ 27 = Volume (cu.yd.)

The volume in cubic yards can be used to determine the amount of fertilizer products that will be needed for the whole area that will be fertilized. This calculation will be similar to adjusting laboratory recommendations, replacing the laboratory recommendation with the label recommendation.

1/2 cup of fertilizer per cubic yard × Volume (cu.yd.) = cups per Fertilized Area

Adjusting fertilizer recommendations to the proper area and volume of the garden is important to maintain nutrient levels for plant growth. These calculations should be used in conjunction with soil tests and fertilizer recommendations. For more information on determining the proper fertilizer to meet the soil test recommendations, reference the UADA publication Understanding Fertilizer Nutrient Content and Guaranteed Analysis (FSA-2222). For more information on fertilizer calculations, soil testing or nutrient recommendations, please contact your local University of Arkansas System Division of Agriculture Cooperative Extension Service or visit https://www.uaex.uada.edu/.

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