Understanding the MSU Soil Test Report for Home Gardening
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Understanding the MSU Soil Test Report for Home Gardening

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A good soil fertility program helps home gardens be productive. The available nutrient status in a garden soil determines what kind and how much fertilizer should be used. Home gardeners may have their soil analyzed by the MSU Soil Testing Laboratory. The following information will help you better understand and use the soil test results.

The MSU soil test report form can be divided into two basic parts:

(1) test results and
(2) fertilizer recommendations.

Soil test results are presented on the left side of the report. (Table 1)

Soil pH indicates the level of active soil acidity or alkalinity. Above 7.0 is alkaline (sweet), 7.0 is neutral, and below 7.0 is acid (sour). A pH between 6.2 and 6.8 is best for most vegetables and flowers.

Table 1. An illustration of the left side of the soil test report form — Test Results.

Test Results	
Sample No.	HG3
Soil pH	6.0
Lime Index	6.7
	lbs. per acre of:
Available Nutrients	
Phosphorus	155
Potassium	307
Calcium	2,027
Magnesium	223
	parts per million of:
Zinc	16
Manganese	27
Copper	
Pct. Org Mat	3.78
Pct. of Total Exchangeable Bases:	
Potassium	6.2
Calcium	79.3
Magnesium	14.5
Sample Data	
Acres	
Soil Texture	3
Manure	No
Plowing Depth	5

Lime Index indicates the need for lime on soils which have a pH less than 6.8. The lime index measures the reserve or potential acidity in soil. With an index of 7.0, no lime is required. A lower index value indicates the need for more lime.

Available phosphorus, potassium, calcium and magnesium are reported in pounds per acre to a depth of 6⅔ inches. For mineral soils, this is approximately the same as parts per 2 million (pp 2 m).

Phosphorus (P) levels less than 40 pounds per acre are very low, 70-150 medium and above 200 very high for home garden soils.

Potassium (K) levels less than 100 pounds per acre are very low, 200 to 300 medium and above 400 very high for home garden soils.

Calcium (Ca) is generally adequate in Michigan garden soils. Even acid soils needing lime generally contain sufficient calcium for good plant growth. This test is used to calculate nutrient balance between potassium, calcium and magnesium and serves in part as a basis for magnesium recommendations.

Magnesium (Mg) is considered adequate above 75 pounds per acre for mineral soils. A magnesium deficiency may occur if magnesium is less than 3 percent of the exchangeable bases or the percent potassium is greater than the percent magnesium (see section on Percent of Total Exchangeable Bases).

Micronutrient analyses are done only on special request. Zinc, manganese and copper levels are reported in parts per million (ppm). Values greater than 10 ppm zinc and 20 ppm manganese are usually adequate for normal growth and production. Mineral soils usually contain adequate levels of copper and iron.

Percent Organic Matter (Pct Org Mat) in soil is determined only on special request.

Percent of Total Exchangeable Bases provides information on the nutrient balance of potassium, calcium and magnesium. The potassium-magnesium relationship is most important (see magnesium). Calcium levels above 60 percent of the total exchangeable bases should be adequate.

Soil Texture is indicated by code:

-ORG is organic
-1 is comprised of clay soils
-2 includes loam, clay loam, sandy clay loam and similar soils
-3 is sandy loam
-4 is loamy sand
-5 is sand soils

ACRES represented by the sample is usually less than one for home gardens.

Manure Applied and **Plowing Depth** are information that you provide when submitting the soil sample. About 46 pounds of manure per 1,000 square feet equals 1 ton per acre. The fertilizer recommendation is reduced according to the amount of manure applied. Applying 460 pounds per 1,000 square feet supplies about 1 pound nitrogen (N), 0.5 pound phosphate (P_2O_5) and 2 pounds potash (K_2O). Plowing depth indicates the depth of tillage.

RECOMMENDATIONS

Recommendations for the amount of additional nutrients required are given on the right side of the report form (Table 2) in terms of pounds of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) per 1,000 square feet. Home garden recommendations are generalized to provide adequate nutrition for a wide variety of vegetables and flowers. A recommendation of 3 + 2 + 2 means 3 pounds N, 2 pounds P_2O_5 and 2 pounds K_2O per 1,000 square feet.

Meeting these nutrient recommendations requires selecting the proper fertilizer materials, either natural or chemical. Home gardens are usually relatively small, so the total quantity of fertilizer required is small. Therefore, home gardeners usually do better for meeting the nutrient needs of the soil with a single mixed fertilizer. If you have a large garden, you may consider using a combination of fertilizer materials.

An understanding of the label on a fertilizer bag is essential. A fertilizer bag is labeled with three numbers which indicate the nutrient content. The first number indicates the percent nitrogen (N), the second the percent phosphate (P_2O_5) and the third the percent potash (K_20) in the fertilizer. For example, a 20-10-5 grade indicates that each 100 pounds of fertilizer contains 20 pounds N, 10 pounds P_2O_5 and 5 pounds K_2O or a 20-pound bag contains 4 pounds N, 2 pounds P_2O_5 and 1 pound K_2O. Some of the more common fertilizers available in Michigan are given in Table 3. In choosing a fertilizer to use, select one which has the N, P_2O_5 and K_2O present in a ratio similar to that of the amounts recommended on the report form.

The following examples illustrate how to use the nutrient recommendations to determine actual fertilizer needs.

Example No. 1

Recommendation is for 3 pounds N, 6 pounds P_2O_5 and 6 pounds K_2O per 1,000 square feet. The ratio of N - P_2O_5 - K_2O needed is 1-2-2. Therefore, a fertilizer material containing these nutrients in this same ratio is desired. One suitable material would be a 10-20-20. To determine the amount of fertilizer needed per each 1,000 square feet of garden area, use the following procedure: (refer also to Table 4)

(a) multiply pounds of N or P_2O_5 or K_2O in the recommendation by 100 and

(b) divide answer of (a) by the N or P_2O_5 or K_2O content in the fertilizer.

This indicates the pounds of fertilizer needed for each 1,000 square feet of garden area. In the case for N, multiplying 3 × 100 equals 300 and dividing by 10 equals 30. This indicates that 30 pounds of a 10-20-20 fertilizer per 1,000 square feet will provide the needed 3 pounds of nitrogen (N). For P_2O_5 and K_2O, multiplying 6 by 100 and dividing by 20 equals 30.

Example No. 2

Recommendation is for 3 pounds N, 1 pound P_2O_5 and 1 pound K_2O per 1,000 square feet. From Table 3, two fertilizers (23-9-9 and 23-7-7) have a similar ratio of about 3-1-1. Now use the procedure described in Example No. 1 and Table 4 to determine how much 23-9-9 fertilizer is needed per 1,000 square feet. To meet the nitrogen (N) recommendation requires 13 pounds (3 × 100 ÷ 23) per 1,000 square feet. To meet the phosphate (P_2O_5) and potash (K_2O)

Table 2. An illustration of the right side of the soil test report form — Fertilizer Recommendations.

SAMPLE	HG3	Exp. Yield	Nitrogen	Phosphate	Potash					Notes
			N	P_2O_5	K_2O	B	Zn	Mn	Cu	
Previous Crop:	Garden									
			---------- Lbs/1,000 Sq. Ft. ----------							
Future Crops:										
1st Yr.	Garden		3	1	1					
Lime needed for pH 6.5 = 64 Lbs/1,000 Sq. Ft.										

recommendations requires 11 pounds (1 × 100 ÷ 9) per 1,000 square feet. Since the answers differ slightly, one can either use the highest rate or compromise halfway.

Example No. 3

Recommendation is for 3 pounds N, 1 pound P_2O_5 and 2 pounds K_2O per 1,000 square feet. In Table 3 there is no fertilizer listed which has N, P_2O_5 and K_2O present in this ratio. Therefore, a fertilizer must be selected which fulfills the nutrient requirements reasonably well. Of the materials listed in Table 3, 23-5-10 comes the closest. Using the procedure described in Example No. 1 and Table 4, 13 pounds (3 × 100 ÷ 23) supplies 3 pounds N, but 20 pounds (1 × 100 ÷ 5 or 2 × 100 ÷ 10) is required to supply 1 pound P_2O_5 and 2 pounds K_2O. In this case, it is better to use the 20-pound rate and get extra nitrogen than compromise and end up short of phosphate (P_2O_5) and potash (K_2O).

Example No. 4 (Using natural fertilizer materials.)

Recommendation is for 3 pounds N, 2 pounds P_2O_5 and 5 pounds K_2O per 1,000 square feet. Natural fertilizer materials usually contain mainly one of the three primary nutrients. Therefore, two or more natural materials are necessary to provide balanced nutrition for vegetables and flowers. Using 9.5 pounds of bone meal (2 × 100 ÷ 21) supplies the required 2 pounds of P_2O_5 per 1,000 square feet. It also supplies about 0.4 pound of nitrogen. As a result, 2.6 pounds N (3.0 −0.4) is still needed. This is supplied by 22 pounds of dried blood (2.6 × 100 ÷ 12). The potash (K_2O) requirement can be met by using 100 pounds of wood ashes (5 × 100 ÷ 5) per 1,000 square feet.

The procedure used in the above examples to fulfill the nutrient (nitrogen, phosphate and potash) recommendations can be applied to any recommendation. First, find out what fertilizer materials are available in your area, then use the worksheet in Table 4 to determine how much fertilizer is needed for each 1,000 square feet of garden area.

When applying the fertilizer, **caution** should be used not to over-fertilize your garden soil. Over-fertilization can reduce vegetable yields and vegetable quality. Excessive nitrogen will delay fruit set and maturity. And excessive potassium may reduce vegetable quality by causing an imbalance with calcium and magnesium. So be sure to use recommended rates for good yields of quality vegetables.

Lime Needs

Where limestone is needed to neutralize soil acidity, the recommendation is given in pounds per 1,000 square feet to bring the soil pH to 6.5. Where magnesium is low, dolomitic lime should be used.

Table 3. Fertilizer materials available for home gardens.*

Name	Grade N - P_2O_5 - K_2O ------ % ------	Approximate Ratio
Ammonium Nitrate	34 - 0 - 0	1-0-0
Dried Blood	12 - 1 - 1	1-0-0
Bone Meal	4 - 21 - 1	1-5-0
Seaweed	1 - 1 - 5	1-1-5
Wood ashes	0 - 1 - 5	0-1-5
Milorganite	5 - 3 - 2	2-1-1
	10 - 20 - 20	1-2-2
Common	12 - 12 - 12	1-1-1
Grades	10 - 6 - 4	2-1-1
Of	10 - 5 - 10	2-1-2
Garden	23 - 7 - 7	3-1-1
Fertilizer	23 - 9 - 9	3-1-1
	20 - 10 - 5	4-2-1
	20 - 5 - 5	4-1-1
	20 - 4 - 8	5-1-2

This is only a partial list to illustrate types of fertilizers available. Discrimination is not intended and endorsement is not implied by the Cooperative Extension Service. Many others are available and suitable for use in home gardens.

Table 4. Worksheet for determining fertilizer needed.

Recommendation N_____; P_2O_5 _____; K_2O_____ lbs/1,000 sq. ft.

Nutrient Ratio _____:_____:_____

Grade of Fertilizer to be used_____ % N;_____ % P_2O_5; _____ % K_2O;

Step 1 — Nutrient Recommendation _____ × 100 =_____ (lbs N or P_2O_5 or K_2O)

Step 2 — Answer from step 1 ÷ Nutrient Content of Fertilizer (% N or % P_2O_5 or % K_2O)

Ans. 1_____ ÷ _____ =_____*

*NOTE: Answer is pounds of fertilizer needed for each 1,000 sq. ft. of garden area.

Step 3 — Repeat steps 1 and 2 for other nutrients of fertilizer if necessary.

Micronutrients

Most mineral soils are adequately supplied with micronutrients, especially if large amounts of organic materials (plant residue, leaves, grass clipping, composted materials, etc.) are worked into the soil. The micronutrients are less available for plant uptake when the soil is alkaline (pH above 7.0). Under this condition a deficiency of iron, zinc or manganese may occur. (See Bulletin E-486, Secondary and Micro-

nutrients.) In this situation, you should obtain a soluble micronutrient material, and spray the plant foliage to correct the deficiency.

If you have questions about interpreting your soil test report, contact your local Cooperative Extension Office. If you have an inquiry pertaining to your soil sample, contact the **Soil Testing Laboratory, Michigan State University, East Lansing, MI 48824.** Indicate the tray number shown at the lower left portion of the soil test report.

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