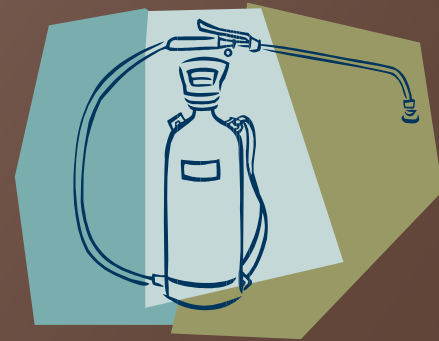


# ANIMAL, PLANT & SOIL SCIENCE

D3-4

## APPLYING FERTILIZERS



# Interest Approach

- As class starts, project a picture of a farm on the screen. (VM–F is provided for this purpose.) Once the students have settled in, ask them what would need to be done to provide crops with optimal amounts of fertilizer nutrients. Guide the discussion so that nutrient testing, application methods, variable rates, and technology are considered.



# Objectives

- ① **Determine the need for the application of fertilizer.**
- ② **Collect soil samples and interpret soil test results.**
- ③ **Identify the methods of fertilizer application.**
- ④ **Determine the appropriate fertilizer application rate.**
- ⑤ **Examine the equipment and technology used to apply fertilizers.**



# Terms

- ◉ banding
- ◉ broadcasting
- ◉ buildup
- ◉ chiseling
- ◉ deep placement
- ◉ fertigation
- ◉ foliar feeding
- ◉ knifing
- ◉ luxury consumption



# Terms

- ⦿ maintenance
- ⦿ pop-up fertilizer
- ⦿ post-emergence
- ⦿ pre-emergence
- ⦿ preplant
- ⦿ root zone banding
- ⦿ sidedressing
- ⦿ site-specific application



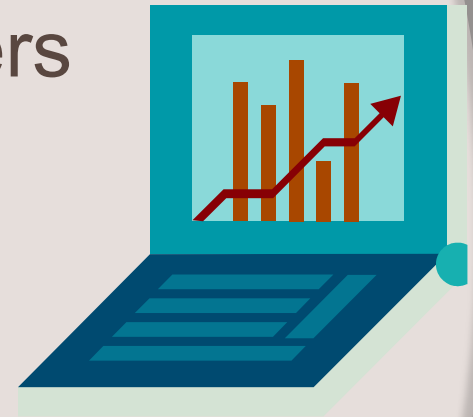
# Terms

- ⦿ soil injection
- ⦿ soil testing
- ⦿ starter fertilizer
- ⦿ tissue testing
- ⦿ top dressing
- ⦿ variable rate
- ⦿ technology (VRT)



# When is the application of fertilizer needed?

- I. Fertilizing can increase yields, and increased yields add to a grower's income. When fertilizers are applied to crops greatly influences yields.



- A. Because fertilizers cost money, a grower must add the amount of fertilizer that is most profitable.



# When is the application of fertilizer needed?



- ⦿ B. The yield of a crop is directly related to the nutrient level of the soil. The nutrient level of a plant can be divided into four levels.



# When is the application of fertilizer needed?

- ① 1. Level I: Deficient—The nutrient is clearly deficient; growth and productivity are affected. After the missing mineral is applied, growth response is strong and profitable.
- ② 2. Level II: Sufficient—A critical level is reached that satisfies plant needs. More fertilizer may increase yields slightly but not enough to pay for fertilizer.



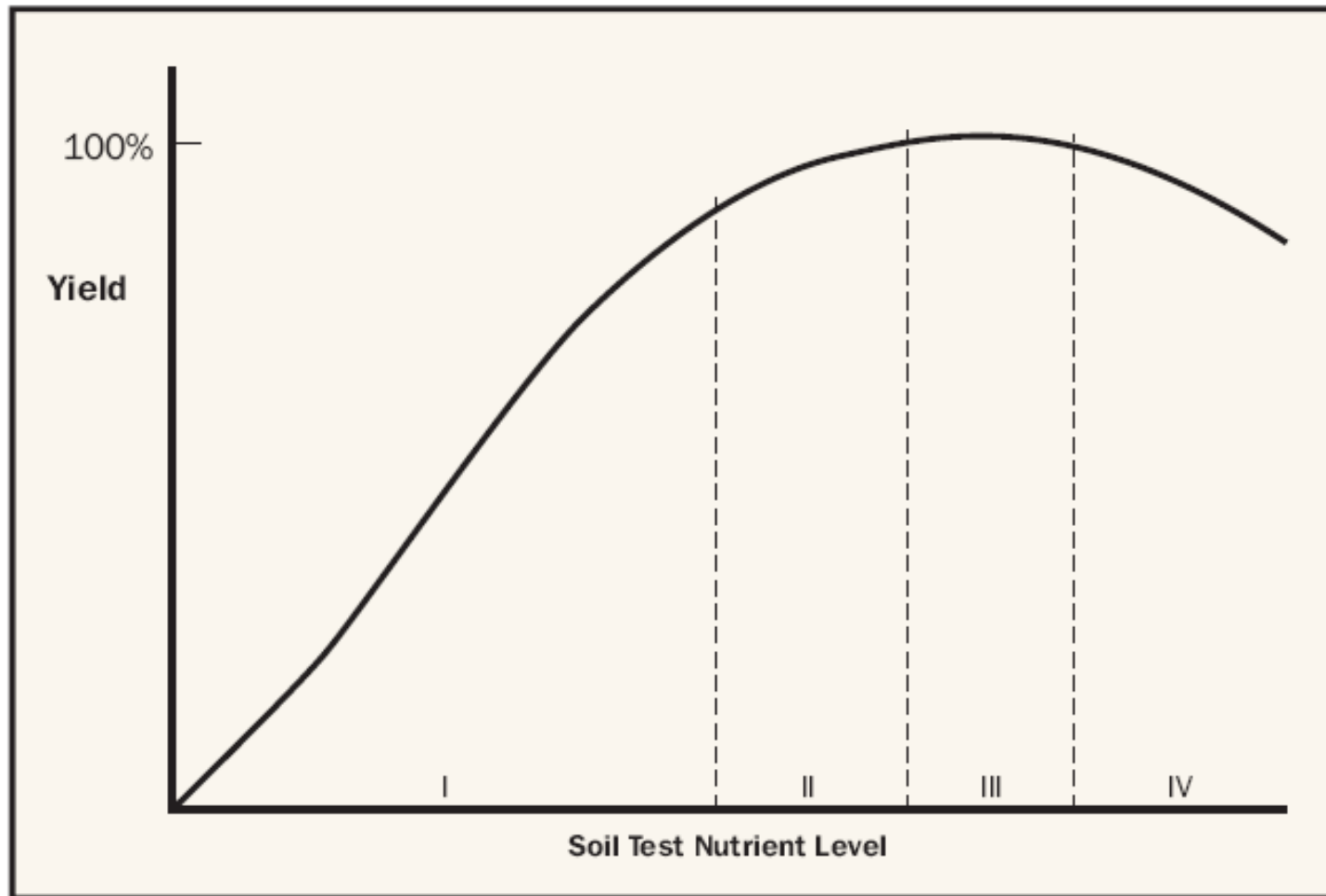
# When is the application of fertilizer needed?

- ③ 3. Level III: High—Nutrient levels are high; yields are maximum. Additional nutrients would be stored in the plant, which is referred to as ***luxury consumption***. Fertilization could shift the plant to Level IV or contribute to water pollution.
- ④ 4. Level IV: Toxic—Nutrient levels in plant tissue are high enough to be toxic. Yields decline.



# SOIL TEST NUTRIENT LEVEL

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The yield of a crop is directly related to the nutrient level of the soil.  
Fertilization is most profitable for crops in Level I.

# How are soil samples collected and test results interpreted?



- II. Three methods can be used to determine nutrient levels. They are visual inspection, plant tissue testing, and soil testing.
- A. Visual inspection of crops for deficiency signs may uncover clear shortages.



# How are soil samples collected and test results interpreted?

- 1. This method often notes only critical shortages after yield damage has already occurred.
- 2. Visual symptoms may be unreliable, since the deficiency of different nutrients may have similar symptoms. Other problems not related to soil nutrient levels may be present that are affecting plant growth.

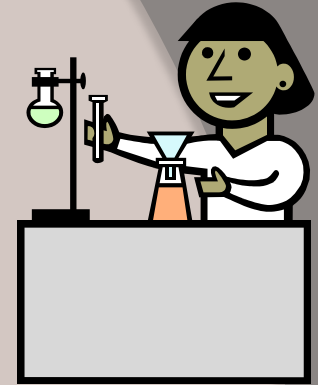


# How are soil samples collected and test results interpreted?

- B. ***Tissue testing*** measures nutrient levels in plant tissue. This type of testing may uncover problems that soil testing misses.



# How are soil samples collected and test results interpreted?



- ◉ C. ***Soil testing*** measures nutrient levels in soil as well as other soil features.
  
- ◉ 1. Testing laboratories operate on one of the two following concepts of fertility levels:
  - a. Fertilizing the soil to bring it to an optimum level, then adding yearly maintenance amounts to replace those lost by crop harvest
  - b. Frequent soil tests followed by fertilization of the plant to supply needs



# How are soil samples collected and test results interpreted?

- 2. Growers depend on these tests to determine the lime and fertilizer needs for crops.
- 3. Soil tests have limits. Conditions that affect nutrient uptake, such as wet soils, cannot be detected in the laboratory.





# What are the methods of fertilizer application?

- III. Producers have a number of options for placement of fertilizer.
- A. Selecting the proper application technique for a particular field depends (at least in part) on the inherent fertility level, the crop to be grown, the land tenure, and the tillage system.



# What are the methods of fertilizer application?

- 1. No significant difference in yield is associated with the method of application on fields where the fertility level is at or above the desired goal.
- 2. Higher yields can be obtained on low-testing soils with the placement of fertilizer within a concentrated band.



# What are the methods of fertilizer application?



- B. Fertilizers can be applied before a crop is planted, while it is being planted, after it is growing, or in some combination of the three. The time of application has different effects on the crop.

# What are the methods of fertilizer application?

- 1. Fertilizer applied before a crop is planted is called ***preplant***.
- 2. The simplest way to fertilize before planting is broadcasting. ***Broadcasting*** is spreading fertilizer evenly on the soil surface.



# What are the methods of fertilizer application?

- 3. **Soil injection**, also known as **root zone banding**, **deep placement**, **knifing**, or **chiseling**, is a process in which fertilizer is placed below the surface in the root zone.
- 4. Fertilizer applied at the time of planting is called **starter fertilizer**. The most common method of applying starter fertilizer is called banding. **Banding** is accomplished when the planter places a band of fertilizer below and to the side of the seeds.
- 5. **Pop-up fertilizer** is placed in the row with the seeds. Only small amounts are applied to prevent seedling damage.



# What are the methods of fertilizer application?

- C. There are several ways to fertilize after planting.
- 1. ***Pre-emergence*** is fertilizing after the planting but before the crop emerges from the ground.
- 2. ***Post-emergence*** is fertilizing after the crop has emerged from the ground.



# What are the methods of fertilizer application?

- 3. **Top dressing** is the same as broadcasting, except that the fertilizer is spread over a growing crop and is not mixed into the soil.
- 4. **Sidedressing** is a way of making a second application of fertilizer halfway through the growing season by fertilizing along the crop row.
- 5. **Fertigation** is a method of injecting fertilizer into irrigation water.



# What are the methods of fertilizer application?

- 6. **Foliar feeding** is fertilizing by spraying solutions directly on the leaves of the crop. This method offers the quickest response of any fertilizing method.
- 7. **Site-specific application**, also known as **variable rate technology (VRT)**, uses computer technology to alter the rate of fertilizer application as the fertilizer applicator passes across the field. This approach offers the potential to improve yield while minimizing the possibility of overfertilization, which results in improved profit.





# AN AIR APPLICATOR IS USED TO APPLY FERTILIZER

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# **PATRIOT™ SPRAYER APPLIES FERTILIZER TO FIELD**

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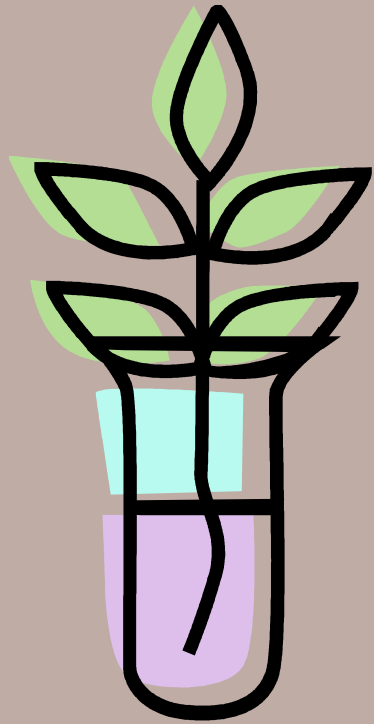


# How is the appropriate rate of fertilizer application determined?

- IV. Rate of fertilizer application depends upon the soil test level.
- A. Soil fertility problems are largely associated with acidity, phosphorus, potassium, and nitrogen. There are recommended soil tests for making decisions about lime and fertilizer.



# How is the appropriate rate of fertilizer application determined?



- 1. The water pH test shows soil reaction as pH units.
- 2. The Bray P1 test is used to determine plant-available soil phosphorus that is commonly reported as pounds of phosphorus per acre (elemental basis).
- 3. The potassium test is commonly reported as pounds of potassium per acre (elemental basis).





# How is the appropriate rate of fertilizer application determined?



- 4. Testing to determine nitrogen fertilizer needs for field crops is not recommended in the same sense as testing for the need for lime, phosphorus, or potassium since nitrogen can change forms or be lost from the soil.
- 5. Testing soil to predict the need for nitrogen fertilizer is complicated by the fact that nitrogen availability, both the release from soil organic matter and the loss by leaching and denitrification, is regulated by unpredictable climatic conditions.



# How is the appropriate rate of fertilizer application determined?

- B. The amount of fertilizer recommended may consist of buildup plus maintenance, maintenance, or no fertilizer. **Buildup** is the amount of material required to increase the soil test to the desired level. **Maintenance** is the amount required to replace the amount that will be removed by the crop to be grown.



# How is the appropriate rate of fertilizer application determined?

- 1. Buildup plus maintenance is applied when soil test levels are below the desired values. It is suggested that enough fertilizer be added to build the test to the desired goal and to replace what the crop will remove. At or below the desired values, the yield of the crop will be affected by the amount of fertilizer applied that year.



# How is the appropriate rate of fertilizer application determined?

- 2. Maintenance is prescribed when the soil test levels are between the minimum and 20 pounds above the minimum for phosphorus or between the minimum and 100 pounds above the minimum for potassium. The application should involve enough to replace what the crop to be grown is expected to remove. The yield of the current crop may not be affected by the fertilizer addition, but the yield of subsequent crops will be adversely affected if the materials are not applied to maintain soil test levels.





# How is the appropriate rate of fertilizer application determined?

- 3. No fertilizer—It is recommended that soil test levels be maintained slightly above the level at which optimum yield would be expected. It would not be economical to attempt to maintain excessively high values.



# What equipment and technology are used to apply fertilizers?

- V. Fertilizer spreaders dispense dry materials over an area. Fertilizers are applied with both sprayers for liquids and applicators for dry materials, such as granules.
- A. Sprayers fall into one of two categories: low pressure (up to 80 psi—pounds per square inch of pressure) or high pressure (up to 500 psi). The main difference in the two types of sprayers is the type of pump used. A low-pressure sprayer is usually equipped with a roller or centrifugal pump. High-pressure units have a positive displacement pump.



# What equipment and technology are used to apply fertilizers?



- B. Applicators involve a large hopper and spinners or a boom. They are powered hydraulically on self-propelled units.
- 1. Self-propelled spreaders are either mounted on truck chassis or large floaters. These units can be adapted to distribute manure or biosolids. A “high-boy” applicator or a floater can apply liquid or dry fertilizers to a field very effectively. It has great width to the boom, and large tires provide high clearance.
- 2. Pull-type units are ground-driven or tractor PTO–driven. The amount of fertilizer applied is regulated by an adjustable gate at the rear of the hopper controls.

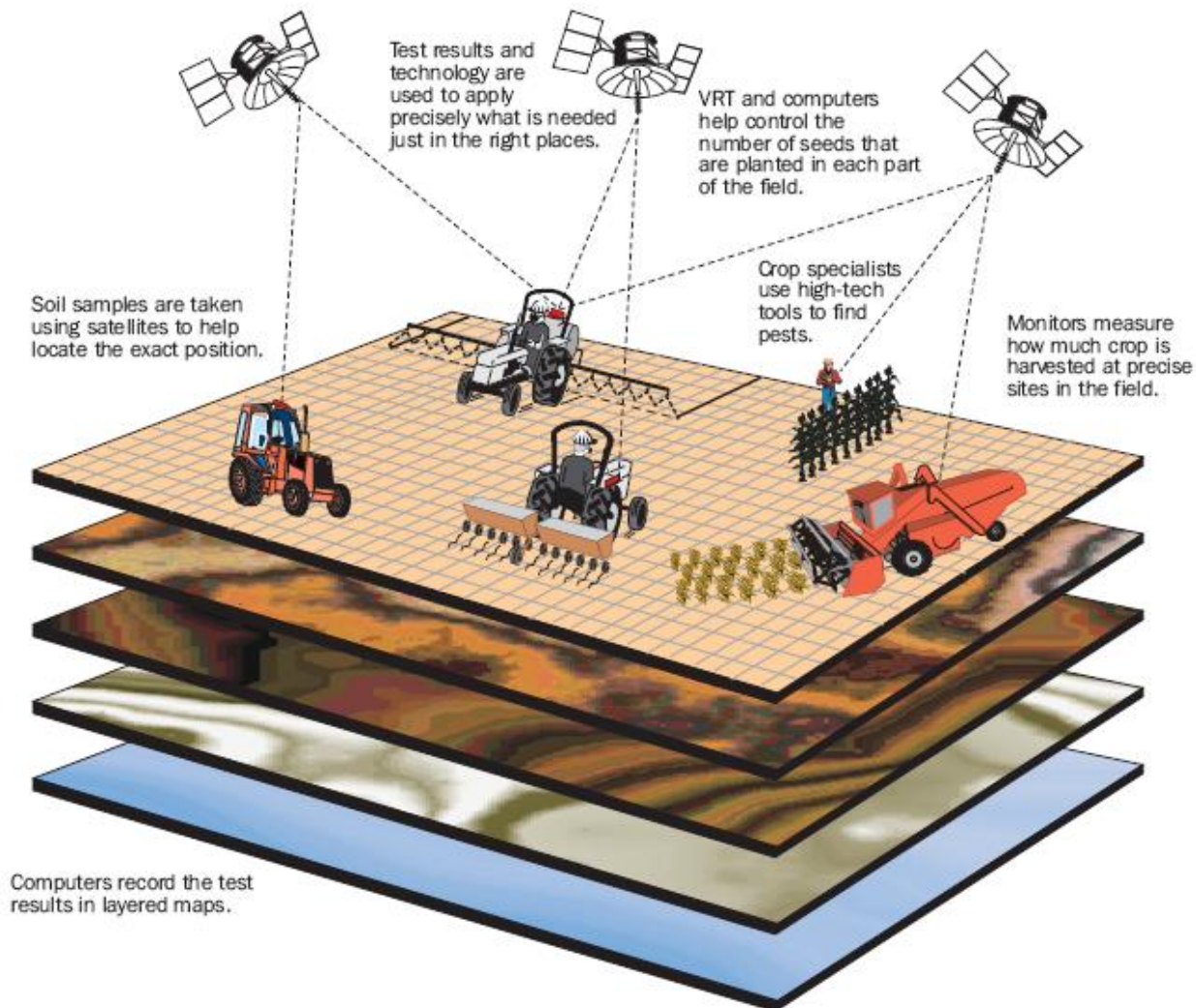


# What equipment and technology are used to apply fertilizers?

- C. Global positioning system (GPS) technology is now widely used as an application of geographical information systems technology. This technology is also called precision farming or site-specific farming.
- 1. GPS relies on satellite signals and ground correction stations to provide an accurate positioning of a receiver, which is mounted on the vehicle being used.
- 2. This technology is used to apply specific amounts of fertilizer to different parts of a field.



# GLOBAL POSITIONING SYSTEM (GPS)



# REVIEW

- ◎ 1. When is the application of fertilizer needed?
- ◎ 2. How are soil samples collected and test results interpreted?
- ◎ 3. What are the methods of fertilizer application?
- ◎ 4. How is the appropriate rate of fertilizer application determined?
- ◎ 5. What equipment and technology are used to apply fertilizers?

