

#### Interest Approach

• Display different types of fertilizers. Ask students to identify the differences they observe. Direct the discussion toward plant nutritional value.





 1 Explain the development of a nutrient management plan.

• 2 Describe organic and inorganic fertilizers.

- 3 Explain fertilizer analysis, grade, and ratio.
- 4 Explain the mixing of fertilizers.
- 5 Describe the selection of fertilizers.



#### Terms

- bulk blending
- complete fertilizer
- fertilizer
- fertilizer analysis
- fertilizer grade
- fertilizer ratio
- filler
- inorganic fertilizer
- mixed fertilizer
- nutrient management plan
- organic fertilizer
- single-grade fertilizer



- I. Nutrient management planning is an effort to balance necessary soil fertility levels with environmental protection.
- A. A *nutrient management plan* identifies the amount, source, time of application, and placement of each nutrient needed to produce the crop grown in a given field each year.





 1. Objectives of a nutrient management plan are to optimize efficient use of all sources of nutrients and to minimize the potential for plant nutrients to degrade water and soil quality. Specific objectives involve soil reserves, commercial fertilizer, legume crops, and organic sources, such as manure, industrial waste, and municipal waste, in crop production.





• 2. A nutrient management plan involves the recognition of sensitive areas within fields that require special nutrient management precautions to avoid environmental contaminations. Those areas include sinkholes, wells, drainage ditches, lakes, streams, and highly erodible land.



- B. A four-year plan, with changes being made after new soil tests have been taken, is most effective.
   Certain steps should be followed in developing a nutrient management plan.
- 1. Assess the natural nutrient sources, soil reserves, and legume contributions.
- 2. Identify fields or areas within fields that require special nutrient management precautions.
- 3. Assess the nutrient needs for each field by crop.



- C. Determine the quantity of nutrients available from organic sources, such as manure, industrial waste, and municipal waste.
- 1. Allocate nutrients available from organic sources.
- 2. Calculate the amount of commercial fertilizer needed for each field.
- 3. Determine the ideal time and method of application.
- 4. Select nutrient sources that will be most effective and convenient for the operation.



II. Agricultural crops use nutrients that are held in the soil. As crops are harvested and removed from the land, nutrients are removed with the plant tissues. To maintain high yields, nutrients must be added to the soil. A *fertilizer* is an organic or inorganic material applied to soil or water which provides nutrients that increase plant growth, yield, and nutritional quality.



- A. An *organic fertilizer* is a material originating from plants or animals that releases useful amounts of a plant nutrient when added to the soil.
- 1. Organic fertilizers can originate as plant or animal tissue, such as animal manure or compost made with plant or animal products.
- 2. Organic commercial fertilizers include dried and pulverized manures, bone meal, slaughterhouse tankage, blood meal, dried and ground sewage sludge, cottonseed meal, and soybean meal.



- 3. Organic fertilizers have notable characteristics.
  - a. Nitrogen (N) is usually the predominating nutrient, with phosphorus and potassium being in lesser quantities. One exception is bone meal, in which phosphorus predominates and N is a minor ingredient.
  - b. Nutrients are only made available to plants as the material decays in the soil; thus, they are slow acting and long lasting.









- c. By themselves, organic materials do not provide a balanced amount of plant nutrients, and their analyses in terms of the three major nutrients are generally low. However, they do contribute to the organic matter content in the soil.
- d. Organic material is bulky, and the exact amount of fertilizer applied is difficult to measure.



- B. An *inorganic fertilizer* is a material originating from a nonliving source and includes various mineral salts that contain plant nutrients in combination with other elements.
- Inorganic fertilizers are manufactured in dry, liquid, or gaseous forms.

- 2. Inorganic fertilizers have different characteristics than organic fertilizers.
  - a. Nutrients are in a soluble form and are quickly available for plant use.
  - b. These soluble nutrients make inorganic fertilizers caustic to growing plants and able to cause injury. Care must be used in applying to growing crops so as not to come in contact with the roots nor remain on plant foliage for any length of time.
  - c. Analyses of inorganic fertilizers are relatively high in terms of the nutrients these fertilizers contain.



#### DISSOLUTION OF FERTILIZERS RELEASES NUTRIENT IONS FOR PLANTS



- III. It is important to know the nutrient content of a fertilizer in order to apply the recommended amount.
- A. *Fertilizer analysis* lists the fertilizer elements in the bag and their percent content.



- 1. This list could include any of the 13 mineral elements.
- 2. The percentage of the three macronutrients is always listed on the fertilizer label in the same order. They appear as nitrogen, phosphorus in the form of phosphoric acid, and potassium in the form of potash.



- 3. Additional information may also be found in the analysis (e.g., the percent of nitrogen that is ammoniacal and the percent that is nitrate).
- 4. Some fertilizers, especially those blended for turf, may contain nitrogen sources that dissolve slowly. These will be identified as water-insoluble nitrogen (WIN) or slow-release nitrogen (SRN).





- B. All bags of fertilizer should show the *fertilizer grade*, indicating the primary nutrient content of the fertilizer.
- 1. The grade lists the content as a sequence of three numbers that tell, in order, the percentage of nitrogen (N), phosphate (P2O5) (also called phosphoric acid), and potash (K2O).
- 2. The grade may also identify a secondary nutrient as a fourth number in the traditional N-P-K content listing. For example, calcium nitrate may carry the grade 15-0-0-30Ca, meaning the fertilizer is 30 percent calcium. Similarly, sulfur (S) or magnesium (Mg) may appear as a fourth number.



- 3. Fertilizer grades never total 100 percent. A 10-10-10 fertilizer is 30 percent nutrient and 70 percent other ingredients. The remainder of the fertilizer is the weight of the other elements that are part of the carrier, such as hydrogen and oxygen.
- 4. A small percentage of fertilizer is filler and conditioner.
  - a. *Filler* may be sand, clay granules, ground limestone, or ground corn cobs and is used to bring a load of bulk fertilizer to a desired weight.
  - b. Conditioner improves the quality of a fertilizer and makes it easier to use.



 C. The *fertilizer ratio* states the relative amounts of nitrogen, phosphate, and potash in fertilizers. Ratios are useful when comparing two fertilizers.

Examples	Grade	Ratio
А	10-10-10	1-1-1
В	20-20-20	1-1-1
С	6-12-12	1-2-2
D	5-15-30	1-3-6



- 1. Examples A and B have the same ratio. This means that one fertilizer can be used in place of the other. Applying one ton of 10-10-10 is the same as applying a half ton of 20-20-20.
- 2. Obtaining fertilizers of different ratios is very useful. The grower simply selects a fertilizer with the ratio recommended by soil test reports. If the test report recommends 100 pounds of nitrogen, 50 pounds of phosphate, and 75 pounds of potash per acre, a single fertilizer with the ratio of 4-2-3 would be ideal.



D. The way the fertilizer grade is listed leads to some confusion. Most people think of fertilizer grade as N-P-K: nitrogen, phosphorus, and potassium. Actually, nitrogen is listed as the element, but the other two nutrients are listed in their oxide forms. The true grade should be listed as N-P2O5-K2O, which is read as nitrogen, phosphoric acid, and potash.



 1. Consider the fertilizer 20-10-10. The numbers would seem to mean that there are 200 pounds of phosphorus in a ton of this fertilizer. Actually, one ton contains only 88 pounds of phosphorus. The amounts of nutrients in a ton of 20-10-10 can be listed in the elemental and oxide forms:

Oxide	Elemental	
Ν	400	400
Р	200	88
к	200	166



- 2. When reading soil test reports or other recommendations, always check to see which form is being used. To convert between the amounts of phosphorus/ phosphoric acid and potassium/potash, the following formulas are used:
- a. P × 2.29 = P2O5
- b. P2O5 × 0.44 = P
- c. K × 1.2 = K2O
- d. K2O × 0.83 = K



#### **GRADE AND ANALYSIS ARE LISTED ON FERTILIZER BAGS**



• IV. Growers can apply a fertilizer containing a single nutrient (i.e., a fertilization operation for each nutrient).

• A. However, it would be more convenient to use fertilizers containing several nutrients.



- 1. A fertilizer containing only one element is called a single-grade fertilizer.
- 2. A fertilizer containing two or three nutrients is called a *mixed fertilizer*.
- 3. A *complete fertilizer* contains all three of the primary elements. Complete fertilizers may or may not include all 13 mineral nutrients.



- 4. To determine the amount of each nutrient in a complete fertilizer, the percentage of the nutrient is multiplied by the weight of the fertilizer. For example, in a 50 pound bag of 20-10-10:
- Nitrogen = 50 pounds × 20% = 10 pounds
- Phosphate = 50 pounds × 10% = 5 pounds
- Potash = 50 pounds  $\times$  10% = 5 pounds





 B. Producers may buy premixed fertilizers, but only a limited number of ratios are available. Fertilizers can be custom blended to mix carriers to obtain the analysis and ratio that best suit the needs of the grower.





- 1. *Bulk blending* is physically mixing solid fertilizer materials into multi-nutrient mixtures.
- 2. Fertilizer bulk-blending plants provide a convenient and economical means of mixing dry fertilizer materials to produce specified ratios and grades of varying nutrient percentages.



- 3. A principle asset of blending is the ability of the blender to produce an unlimited number of ratios and grades to suit individual needs. The reasons blending is attractive are economy, versatility, and convenience.
- 4. The finished raw materials of nitrogen, phosphate, and potassium fertilizers can be produced in large economic plants in different areas and combined in the market area.





- 5. Practically any grade or ratio can be produced.
- 6. A bulk-spreader truck can carry freshly blended material directly to the field. No bagging or storage of fertilizers or labor is required.
- 7. Two primary disadvantages of bulk blending are that the materials must have approximately the same particle size and they must be chemically compatible.



### How are fertilizers selected?

 V. Growers can choose from a wide variety of fertilizers.

• A. Factors influencing the selection of fertilizers include:

1. Crop to be fed
2. Time of year
3. Application method
4. Cost





#### How are fertilizers selected?

 B. For most crops, the form of the fertilizer is not critical. The form absorbed does depend somewhat on weather conditions.



1. Plants absorb both the nitrate and ammonium nitrogen. But the preference is the nitrate form. However, under warm moist conditions, ammonium ions will nitrify to nitrate nitrogen in four to six weeks. For that reason, ammonium and nitrate usually have the same effect on crop growth. On the other hand, nitrates are lost more easily from the soil.



#### How are fertilizers selected?

2. Growers need to be concerned with crop sensitivity to certain elements and a fertilizer's effect on soil pH or salinity. The selection of fertilizers usually depends on the price. The least costly fertilizer per pound of plant food is the one commonly selected.







2. What are organic and inorganic fertilizers?

3. What are fertilizer analysis, grade, and ratio?

4. How are fertilizers mixed?

5. How are fertilizers selected?

