ARE ALL fertilizers the same? Of course not, but how do they differ? Knowing the types of fertilizers available is important to producers for economic and environmental reasons. Efficient production may also hinge on the fertilizer used. This unit discusses important aspects of fertilizers.

**Objective:**

Explain fertilizer formulations.

**Key Terms:**

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

**Understanding Fertilizer Formulations**

Agricultural crops use nutrients for growth and development. Field crops absorb the nutrients from the soil. The removal of plant tissues through harvest leads to a depletion of nutrients from the soil. To maintain high yields, nutrients must be added to the soil.

**NUTRIENT MANAGEMENT PLAN**

Nutrient management planning is an effort to balance necessary soil fertility levels with environmental protection. 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.
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. The objectives of a nutrient management plan for crop production include consideration of soil reserves, commercial fertilizer, legume crops, and organic sources of nutrients, such as manure, industrial waste, or municipal waste.

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.

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 a field or areas with fields that require special nutrient management precautions.
3. Assess the nutrient needs for each field by crop.
4. Determine the quantity of nutrients that will be available from organic sources, such as manure, industrial wastes, or municipal wastes.
5. Allocate nutrients available from organic sources.
6. Calculate the amount of commercial fertilizer needed for each field.
7. Determine the ideal time and method of application.
8. Select nutrient sources that will be most effective and convenient for the operation.

**FERTILIZERS**

A fertilizer is a material applied to soils or water that provides nutrients that increase plant growth, yield, and nutritional quality. There are organic fertilizers and inorganic fertilizers.

**Organic Fertilizers**

An organic fertilizer is organic material that releases or supplies useful amounts of a plant nutrient when added to a soil. Organic fertilizers can originate as plant or animal tissue...
and include animal manures and compost made with plant or animal products. Organic commercial fertilizers include manures, bone meal, blood meal, sewage sludge, and vegetative compost. Nitrogen is usually the main nutrient provided, with lesser quantities of phosphorus and potassium. Nutrients are only made available to plants as the material decays in the soil, so they are slow acting and long lasting. They contribute to the organic matter content in the soil. The material is bulky, and the exact amount of fertilizer applied is difficult to measure.

**Inorganic Fertilizers**

Inorganic fertilizers are those from a non-living source and include various mineral salts, which contain plant nutrients in combination with other elements. Inorganic fertilizers are manufactured in dry, liquid, or gaseous forms. Inorganic fertilizer nutrients are in a soluble form and are quickly available for plant use. Analysis of inorganic fertilizers is relatively high in terms of the nutrients they contain.

**FERTILIZER ANALYSIS**

Fertilizer analysis states the elements in a fertilizer, along with the percentage of the elements in the fertilizer. The percentage of the three macronutrients is always listed on the fertilizer label in the same order. They appear as nitrogen, phosphoric acid, and potash, or N–P–K.

All bags of fertilizer should show the fertilizer grade, which indicates the primary nutrient content of the fertilizer. The fertilizer grade lists the content as a sequence of three numbers that indicate, in order, the percentage of nitrogen (N), phosphate (P2O5) (also called phosphoric acid), and potash (K2O). Fertilizer grades never total 100 percent. A 10–10–10 fertilizer is 30 percent nutrient and 70 percent other ingredients. The other ingredients include filler and conditioner. Fillers may be sand, clay granules, ground limestone, or ground corn cobs. Conditioners are substances that improve the quality of the fertilizer and make it easier to use.

Fertilizer ratio states the relative amounts of nitrogen, phosphate, and potash in fertilizers. Ratios are useful when comparing two fertilizers. The ratio for a 20–20–20 fertilizer is 1–1–1, and the ratio for a 5–15–30 fertilizer is 1–3–6.
The way fertilizer grade is listed leads to some confusion. Nitrogen is listed as the element, but the phosphorus and potassium are listed in their oxide forms. Consider a 100 pound bag of 20–10–10 fertilizer. Twenty percent of the bag is nitrogen, which, in this case, equals 20 pounds. Ten percent of the bag is P2O5. To get the actual amount of phosphorus, 10 must be multiplied by .44. Ten percent of the bag is K2O. For actual potassium content, 10 must be multiplied by .83. So, in a 100 pound bag of 20-10-10 fertilizer, there is 20 pounds nitrogen, 4.4 pounds phosphorus, and 8.3 pounds of potassium.

**FERTILIZER MIXES**

Fertilizers can contain a single nutrient or a number of nutrients. Those containing only one nutrient are called single-grade fertilizers. Of course, single-grade fertilizers mean a fertilization application for each nutrient. Therefore, it is more convenient to use fertilizers that contain several nutrients. Fertilizers that contain two or three nutrients are called mixed fertilizers.

Complete fertilizers have all three of the primary elements. Complete fertilizers may or may not include all 13 mineral nutrients. To determine the amount of each nutrient in a complete fertilizer, the percentage of the nutrient is multiplied by the weight of the fertilizer. Fertilizers can be custom blended to obtain the analysis and ratio that best suits the needs of the grower.

**Bulk Blending**

Producers may buy a premixed fertilizer, but a limited number of ratios are available. Fertilizer can be custom blended to mix carriers to obtain the analysis and ratio that best suits the needs of the grower.

Bulk blending is physically mixing solid fertilizer materials into multi-nutrient mixtures. 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.

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. 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. Practically any grade or ratio can be produced. A bulk-spreader truck can carry freshly blended material directly to field. No bagging or storage of fertilizers or farmer labor is required.

The disadvantages of bulk blending are that materials must have approximately the same particle size and be chemically compatible.

**FERTILIZER SELECTION**

A wide variety of fertilizers are available. Factors influencing the fertilizer selection include the crop to be grown, the time of year, the application method, and the cost. For most crops, the form of the fertilizer is not critical. The form absorbed will depend somewhat on the weather conditions.

Plants absorb both nitrate and ammonium nitrogen, but the nitrate form is preferred by many growers. However, under warm, moist conditions, ammonium ions nitrify to nitrate in four to six weeks. For that reason, ammonium and nitrate usually have the same effect on crop growth. It should also be noted that nitrates are lost more easily from the soil.

Growers need to be concerned with crop sensitivity to certain elements and about a fertilizer’s affect on soil pH or salinity.

The selection of fertilizer commonly depends upon the price. The least costly fertilizer per pound of plant food is the one commonly selected.

**Summary:**

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.

A fertilizer is a material applied to soils or water that provides nutrients that increase plant growth, yield, and nutritional quality. There are organic fertilizers or inorganic fertilizers.
Fertilizer analysis states the elements in a fertilizer along with the percentage of the elements in the fertilizer. The fertilizer grade indicates the primary nutrient content of the fertilizer. The fertilizer ratio states the relative amounts of nitrogen, phosphate, and potash in the fertilizer.

Fertilizers containing only one element are called single-grade fertilizers. Fertilizers that contain two or three nutrients and are called mixed fertilizers. Complete fertilizers have all three of the primary elements.

Factors influencing fertilizer selection include the crop to be grown, the time of year, the application method, and the cost.

**Checking Your Knowledge:**

1. What is a nutrient management plan?
2. How do organic and inorganic fertilizers compare?
3. What are the differences among fertilizer analysis, fertilizer grade, and fertilizer ratio?
4. What are single-grade fertilizers, complete fertilizers, and bulk fertilizers?
5. What factors influence fertilizer selection?

**Expanding Your Knowledge:**

Visit a farm service supply store and see what types of fertilizers they offer. Find out which fertilizer provides the highest percentage of nutrients. Inquire about how the fertilizers are packaged. Calculate which fertilizers are most economical. Determine which are easiest to apply and which are most environmentally friendly.

**Web Links:**

- **Fertilizers and Plant Nutrients**
- **Fertilizer**
- **Agricultural Career Profiles**
  [http://www.mycaert.com/career-profiles](http://www.mycaert.com/career-profiles)