What you should know about

Fertilizers

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What you should know about fertilizers

Fertilizers supply plant nutrients to help plants grow and improve crop quality. The ideal fertilizer gives the plant the food it needs.

The major food elements needed by plants are nitrogen, phosphorus, potassium and, to a lesser extent, sulphur, calcium and magnesium. Other elements are also required in very small quantities.

Since major elements are necessary for plant growth, any deficiency will reduce yield. As plants are cropped or harvested year after year, these elements are soon depleted from the soil. If the soil fertility is to be maintained (or even increased), they must be replaced by the addition of fertilizers.

Plant nutrients made from chemicals are called INORGANIC fertilizers. Those obtained from manures, crop residues and composts are called ORGANIC fertilizers. In whatever form, a fertilizer's purpose is to supply the plant with readily available food. Ideally, it should be inexpensive to produce, be easily and quickly applied and not cause any harm or injury to the plant.

Farmers depend on fertilizers to get the highest possible crop yields at the lowest possible cost. Apartment dwellers and homeowners also need them for their house and garden plants. Canadians use over 1 million tonnes of chemical fertilizers a year; world demand is well over 100 million tonnes and is rising rapidly.

FIGURE 1. These research plots show how hay yields can be increased substantially by the timely application of fertilizer.

IMPROVING SOIL FERTILITY

Plants have the ability to take up inorganic elements from the soil and, with the help of the sun's radiant energy, transform them into organic matter. This process is called PHOTOSYNTHESIS. Dead plants, crop residues and manures are all useful as fertilizers, since the organic matter therein is slowly reverted back into its basic elements. Also, plant organic matter improves the condition and the moisture-holding capacity of the soil.

Some soil types, notably clays, are excellent reservoirs for plant nutrients. Others, such as muck soils and peat bogs, have excellent moisture-holding capacity but lack nutrients. Lastly, sandy soils are not only poor in nutrients, due to leaching, but also retain moisture very poorly.

Legumes (alfalfa, clover, soybeans, etc.) are soil-improving crops. They add extra nitrogen to the soil because of nitrogen-fixing bacteria that form nodules on their roots. These bacteria have the ability to convert atmospheric nitrogen to a form that can be used by the plants.

Earthworms also provide nutrients for growing plants. They move the soil around to aerate it, hasten the decomposition of organic materials, and leave valuable castings in the ground.

Green manure crops of fall rye, clover or buckwheat are also useful sources of nutrients, when incorporated into the soil.

Farm manures are the most valuable byproducts of the farm, and because of their organic matter, are well known as soil conditioners. The value of manures is becoming more important because of the rising price of chemical fertilizers. Application of manure to the soil returns a large part of

the plant food removed by crops, and especially the major elements of fertility (nitrogen, phosphoric acid and potash) in forms more or less available for plant growth. The composition of manure varies with the kind of animal producing it. Sheep and poultry manures are richer in plant-food constituents than cattle or horse manures.

This table shows how much nitrogen, phosphate and potash are released by the application of 10 tonnes per hectare of cattle, swine and poultry manure.

	Nitrogen (N) kg/h	Phosphate (P_2O_5) kg/h	Potash (K_2O) kg/h
Cattle manure	55	10	30
Swine manure	65	15	50
Poultry manure	150	40	30

Organic fertilizers and conditioners, such as composted plant materials, are gaining in popularity as people become more aware of the energy saved by recycling refuse. Vegetable waste from the garden, leaves and some household garbage can be successfully turned into rich compost; the composting breaks down raw organic matter into a stable form that can benefit both soil structure and plants.

Some industrial byproducts can be used as fertilizer, too. For example, bonemeal is a good source of phosphorus; it is used mainly to stimulate root growth in newly planted trees. Mushroom-farm compost, when locally available, is also a popular alternative to chemical fertilizers for home gardens. Fish has long been known as a good source of fertilizer, and farmers have recently begun to use some unpolluted sludges.

Limestone, hydrated lime, marl and sea shells are all used as soil additives, although they are not fertilizers. Their main function is to neutralize acidity in the soil, making some plant nutrients more available for growth. Most crops prefer a near-neutral soil for optimum growth.

CHEMICAL FERTILIZERS

Inorganic or chemical fertilizers contain one or more nutritive elements. In most cases, two or more are combined in predetermined amounts to form "mixed fertilizers". This is mostly a convenience; since soils need nutrients in certain proportions, it is more convenient and cheaper to buy them already mixed.

MAJOR OR PRIMARY ELEMENTS Plants have a special need for nitrogen, phosphorus and potassium in fairly large amounts.

Nitrogen is the most important element and is required in large amounts. It gives plants their dark green color, is essential for protein synthesis, and promotes vigorous and fast stem and leaf growth. Nitrogen

is formed into compounds that comprise up to 50% of the living and reproductive substance of plant cells. Ammonia is the basic nitrogen fertilizer material, and the major nitrogen fertilizers are ammonium nitrate and urea (made by reaction of ammonia and carbon dioxide). An efficient fertilizer should supply enough nitrogen to give rapid greening, and then ration the rest over a prolonged period.

Phosphorus stimulates early root growth, to give the plant a good start, helps seeds and fruits form and mature, and provides winter hardiness for roots. When combined with oxygen, it forms ammonium phosphate (P_2O_5), the common form of phosphate used in fertilizers.

An adequate supply of potassium produces strong, stiff stalks and stems, increases disease resistance and helps plants to use soil moisture. The potassium is in the form of potash (K_2O) in fertilizer.

When a fertilizer supplies all three major elements — nitrogen, phosphorus and potassium — it is known as a "complete" fertilizer.

SECONDARY ELEMENTS Magnesium, calcium and sulphur are important to plants and may be required in relatively large amounts. While most soils provide adequate amounts, others require the addition of these nutrients.

MICRO (MINOR) ELEMENTS Boron, chlorine, copper, iron, manganese, molybdenum and zinc are as important to the plants as some of the other elements, but are needed only in minute amounts.

FORMS OF CHEMICAL FERTILIZERS

Fertilizers are most commonly available in granular form. However, for ease of application or because of manufacturing methods, some nutrients come as liquids, slurries, suspensions, solutions, compressed gases or powders. This has enabled the farmer to combine several operations. For example, the use of a nitrogen solution may allow the farmer to mix in a herbicide and apply it at the same time. New home lightweight fertilizers which use coconut shells, corn cobs, etc. as carriers are light, easy to carry and have high nitrogen formulations with varying phosphorus and potassium.

REQUIRED PACKAGE INFORMATION

All fertilizers for sale must show the guaranteed analysis on the package. This states the content of the three main nutrients: nitrogen, phosphate (a form of phosphorus) and potash (a form of potassium). It is shown by a series of three numbers. For example, if the numbers 10-10-10 appear on a 30 kg bag of fertilizer, it means that the bag contains 10% of each raw material — 3 kg of nitrogen, 3 kg of phosphate and 3 kg of potash.

Figure 2 shows the minimum information that must appear on the bag.

In addition, the package must also include directions for use, if the fertilizer is intended for the home environment. This is important for small areas, to avoid crop damage from applications other than at suggested levels.

Packages of organic fertilizers, such as compost, composted manure, etc. must also show the minimum percentage of organic matter and maximum percentage of moisture.

Agriculture Canada inspectors make regular checks to ensure that all requirements are being met.

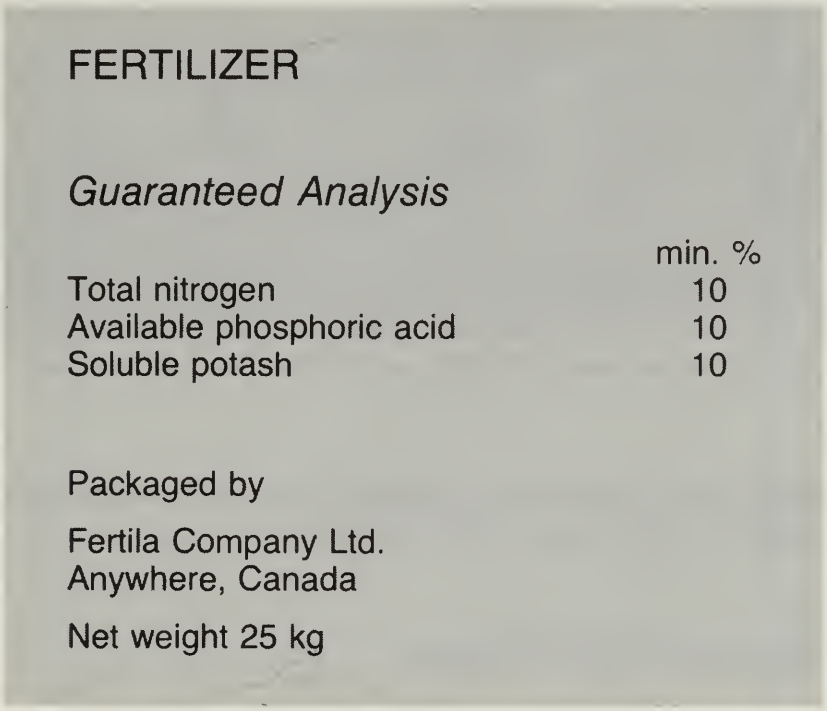

FIGURE 2. The minimum information that must appear on a fertilizer bag.

METHODS OF APPLICATION

Broadcasting is the most common way of applying chemical fertilizers or manures. However, other methods can be used. At seeding time, the fertilizer can be combined with seed in the drillbox, for insertion into the soil; it can also be applied in bands near the root zone of row crops.

Material such as aqua ammonia and anhydrous ammonia must be knifed into the soil to prevent evaporation losses, while nitrogen solutions and other liquid fertilizers are sprayed on the ground or the foliage of plants.

In hydroponic culture, no soil is used; the plants grow in a nutrient (fertilizer) solution. Where sawdust, vermiculite or straw bales are used in place of soil for physical plant support, the fertilizer solution is fed through trickle irrigation to provide the nutrients and moisture to the plants.

FIGURE 3. Applying anhydrous ammonia, by knifing it into the ground between rows of corn.

Recently, new methods for spreading liquid manure have included the use of irrigation systems and drainage pipes.

WISE USE OF FERTILIZERS

Soil tests should be performed to determine fertilizer requirements before use. Recommendations are based on the findings from field experiments with various crops.

The choice of fertilizer depends, among other things, on availability and price of the product and convenience of application. Recommended rates of application must be observed, as an excess of fertilizer reduces profits and can harm the crop.

We must be careful not to over-enrich the soil with nutrients to avoid leaching and runoff into rivers and lakes, causing "eutrophication". Eutrophication indicates high nitrogen and phosphorus levels, which stimulate excessive growth of aquatic organisms such as algae.

Too much nitrogen can delay or prevent crop maturity — for example, tomatoes that don't turn red and crops that take a very long time to ripen. Excessive nitrogen in the form of nitrates can poison young animals.

Phosphorus can accumulate in the soil, if not needed by the crop. Excesses may tie up some minor elements, such as zinc and magnesium, so that they cannot be assimilated by the plants. Similarly, highly acidic soils

can make some nutritive elements more available to the plants, even to toxic levels, while others remain less available. An application of limestone will usually correct this situation. The recommended soil tests can identify these problems.

Intensified animal production and the trend towards larger herds cause manure disposal problems in some areas. Runoff from manure piles or animal feedlots can eventually reach creeks, rivers and lakes. If you have this problem, ask your provincial government for advice.