Fertilizers — Basic Chemicals

By RALPH F. JONES

Fertilizers supplement the fertility of the soil and supply the essential elements plants use to manufacture their own food.

Plants require 17 essential elements for normal growth. Three of these elements, carbon, hydrogen and oxygen, come from air and water. These elements are needed in large quantities and are necessary for the production carbohydrates, fats and protein. The elements that are supplied by the soil and/or the application of fertilizers include the primary, secondary, and trace elements. The primary elements are nitrogen, phosphorus, and potassium. The secondary elements include calcium, magnesium, and sulfur plus sodium, which has been added to the list recently. The trace elements include manganese, iron, copper, zinc, boron, molybdenum and chlorine. Chlorine is not considered an essential ingredient of fertilizers as there normally is an abundance of this element. We generally are more concerned with an over supply of chlorine than a shortage.

The essential elements each have certain functions in the plant. There are also a number of materials available that contain these elements in a plant-usable form. In order to acquaint you with some of the main functions of these elements and the available materials, each element will be listed with this information given. The plant food content of each material will be given in either the elemental or oxide form and in some cases both. In Florida, most elements are guaranteed as oxides. Please note that some materials are listed under more than one heading as they supply more than one essential element.

Nitrogen — Promotes growth and color, necessary for protein formation

Natural organic nitrogen materials

Sewage sludges	5% to 6% N
Castor Pomace	4% to 6% N
Cotton Seed Meal	4% to 7% N

Synthetic organic nitrogen materials

Urea (all water soluble)	46% N
Ureaform (mostly water soluble)	38% N

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Chemical Nitrogen Materials

Ammonium Nitrate	33.5% N
Ammonium Nitrate Limestone	20% N
Ammonium Sulphate	21% N
Nitrate of Soda	16% N
Potassium Nitrate	13% N
Monoammonium Phosphate	11% N
Diammonium Phosphate	16% to 21% N

Phosphorus — Promotes root development and seed formation

Sources

Superphosphate	18% to 20% P^2O^5
Triple Superphosphate	42% to 56% P^2O^5
Monoaamonium Phosphate	48% to 60% P^2O^5
Diammonium Phosphate	46% to 53% P^2O^5

Potassium — Necessary for cell division, builds structure, hardens plants, increases disease resistance.

Sources

Muriate of Potash	60% to 62% K^2O
Sulphate of Potash	48% to 50% K^2O
Potassium Nitrate	44% K^2O
Nitrate of Soda—Potash	14% K^2O

Calcium — Stimulates root and normal leaf development, corrects soil acidity

Sources

Dolomitic Limestone	22% Ca 30% CaO
Hydrated Lime	54% Ca 75% CaO
Superphosphate	20% Ca 28% CaO
Calcium Sulphate (gypsium)	22% Ca 30% CaO

Magnesium — Necessary for chrorophill formation

Sources

Dolomitic Limestone	11% Mg 18% MgO
Magnesium Sulphate	18% Mg 29% MgO
Sulphate of Potash Magnesia	11% Mg 18% MgO

Sulphur — Necessary for protein formation and chlorophill development

Sources

Superphosphate	12% to 14% S	30% to 35% So^3
Calcium Sulphate	15% to 18% S	37% to 45% So^3
Sulphate of Ammonia	23% S	57% So^3
Sulphate of Potash	17% S	42% So^3
Magnesium Sulphate	24% S	60% So^3

Sodium — May be utilized by the plant in place of potassium but cannot be used to replace all potassium in the plant. Normally not considered a necessary element in a fertilizer program. Nitrate of soda is a material that contains sodium.

Manganese — Necessary for metabolism and photosynthesis

Sources

Manganese Sulphate	23% to 25% Mn 29% to 32% MnO

Iron — Essential for chlorophyll formation

Source

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Iron Sulphate	18% to 20% Fe	25% to 28% Fe^2O^3
Iron Chelate	6% to 12% Fe	8% to 17% Fe^2O^3
Fritted Iron	14% Fe	20% Fe^2O^3
Activated Sewage Sludge	4% to 5% Fe	5% to 7% Fe^2O^3

Zinc — Associated with plant enzyme systems and certain metabolic processes

Sources

Zinc Sulphate	36% Zn	44% ZnO

Copper — Necessary for chlorophyll formation. Acts as a catalyst in some plant processes.

Sources

Copper Sulphate	25% Cu	31% CuO
Copper Oxide	50% to 75% Cu	62% to 93% CuO

Boron — Necessary for normal cell division and protein formation. Aids setting of flowers and fruit.

Source

Borax	11% B	35% B^2O^3

Molybdenum — Plays a part in nitrogen utilization.

Source

Sodium Molybdate	39% Mo	58% MoO^3

Chlorine — Present in plant tissue but not considered a necessary element in a fertilizer program. Concern is given to an excess, rather than a deficiency.

Now that we have covered the essential elements and the fertilizer materials that supply these elements, I would like to supply some information on manufactured fertilizers. As you know, manufactured fertilizers are the most common source of plant nutrients. They are identified by analysis numbers and/or by brand name. The common practice is to refer to the commercial fertilizers by the analysis numbers whereas many specialty fertilizers are referred to by brand name. In either case, the fertilizer will have a guaranteed analysis which is printed on a tag or may be printed on the bag.

The analysis numbers, such as 16-4-8 give the percent nitrogen, available phosphoric acid and water soluble potash in a fertilizer mixture. The first number (16) always refers to nitrogen, the second number (4) available phosphoric acid, and the third and last number (8) water soluble potash. If a mixed fertilizer did not contain all three of the primary plant foods, then a zero would be indicated in the analysis for the missing element. For example, an 8-0-8 fertilizer would be one that did not contain available phosphoric acid. A 0-14-14 would not contain nitrogen.

The guaranteed analysis, as required by the Florida Fertilizer Law, gives the percent of the primary, secondary and trace elements, if present, in a mixed fertilizer. It also gives a breakdown of the nitrogen into nitrate, ammonical, water soluble organic nitrogen and water insoluble organic nitrogen. It also lists the materials that were used to manufacture the fertilizer. In florida, a mixed fertilizer must contain a minimum of 16 units or 16% plant food (the minimum may vary depending on

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state laws), if it is to be offered for general sale. Most fertilizers today contain more than the 16% minimum. The question is often asked, why the low percentages of plant nutrients in a mixed fertilizer. Why is it not possible to buy fertilizer containing 100% plant food? Plants use fertilizer nutrients in a combined form. In checking, you will note that the materials containing plant nutrients in a combined form as listed under the various elements are relatively low in plant food. It is not possible to take materials that are relatively low in plant food, combine them in a mixture, and come up with a fertilizer containing 100% plant food or high percentages of plant foods. When formulating a mixed fertilizer, the manufacturer will use the best materials available at the most favorable cost per unit of plant food.

Most quality fertilizers for turf contain some organic nitrogen. Fertilizers that contain organics usually are referred to as a 25% organic or 50% organic etc. This percentage refers to the percent organic nitrogen in the fertilizer. This does not refer to the amount of organic material (pounds of organic) in the mixture, but rather refers to the portion of the nitrogen content that derived from organic materials. To determine the percentage of organic nitrogen in a fixed fertilizer, add the amount of water soluble organic and water insoluble organic guaranteed in the mixture and divide by the total nitrogen, then multiply by 100. Listed below is the nitrogen breakdown from the guaranteed analysis (Florida) for an 8-4-6 fertilizer that contains 25% natural organic nitrogen. This is an example showing how the organic nitrogen content can be figured.

Example: 8-4-6 analysis

TOTAL NITROGEN	8.00%
Nitrate Nitrogen	2.00%
Ammoniacal Nitrogen	4.00%
Water Soluble Organic Nitrogen	0.20% } 2%
Water Insoluble Nitrogen	1.80% }

$$8 \overline{)\ .25 \times 100 = 25\% \text{ Organic Nitrogen}}$$

2.00 +
16

40
40

The formula for a mixed fertilizer is quite often confused with the analysis. The formula actually is used in the manufacturing process to arrive at the particular analysis and type mixture desired. "Filler" is another term used in connection with mixed fertilizers. It is a low plant food or non plant food material that is used to standardize weight in some low analysis all checmial mixtures. High analysis fertilizers and mixtures that contain high amounts of natural organic nitrogen contain very little or no filler.

The cost of a fertilizer is determined by the analysis and the materials used to formulate a particular mixture. A fertilizer that contains good slow acting organics and secondary and trace elements would cost considerably more than a fertilizer with an identical analysis but that

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did not contain these ingredients. Fertilizers can have identical analysis numbers but vary in price and quality and the results produced. Price comparisons should be made based on pounds of product of comparable quality and analysis or the pounds of fertilizer (comparable quality) needed to supply the amount of actual plant food desired for a given area, regardless of whether the fertilizer is in a pulverized, pelletized, lightweight, soluble, or liquid form. Other factors such as labor saving, ease of application, and results should also enter into the final decision as to which would be the best to purchase.

The forms of fertilizer that are available include pulverized, which is a mixture of dry fertilizer materials and can be made in small quantities, (a few tons at a time), or pelletize or granular fertilizers that are manufactured by mixing solutions and dry materials together and that are made in large quantities (several hundred tons at a time) in a continous process. Bulk blend mixtures are made up of a mixture of granular materials physically mixed together. Solubles are made with fertilizer ingredients that readily dissolve in water and that can be applied with a sprayer or through an irrigation system. A liquid fertilizer is one that contains the soluble ingredients in a liquid form for spray application or by injection through an irrigation system.

Application rates for fertilizers and particularly fertilizers for turf, are usually determined by the nitrogen content. Normally from one to two pounds of N (nitrogen) per 1,000 sq. ft. would be applied for feeding of a regular dry fertilizer. Soluble or liquid fertilizers are usually applied at lower rates per feeding, with more applications for season or year than dry fertilizers. A hundred pound bag of 6-6-6 contains 6 lbs. of N, whereas a hundred pounds of 16-4-8 contains 16 pounds of N. To determine the amount of fertilizer to apply, divide the percent nitrogen into 100, which will give the pounds of product necessary to apply one pound of N. Multiply this figure by the number of pounds or fractions of pounds of N desired, to obtain the rate to use. An example, using a 16-4-8 fertilizer, is listed below.

Example: 16-4-8

$$16 \overline{)100} = 6.25$$

96
40
32
80
80

6.25 lbs. 16-4-8 will apply 1 lb. of N per 1,000 sq. ft. If 2 lbs. of N is desired, multiply by 2, which equals 12.5 lbs. of 16-4-8

For your information, several common fertilizer materials and some popular mixed fertilizers are listed below by analysis with the number of pounds of product necessary per 1,000 sq. ft. to apply from a low rate of ½ lb. of N, up to a high rate of 2½ lbs. of N per 1,000 sq. ft. Chemical materials and soluble or liquid fertilizers should be applied at the lower rates with more frequent applications.

RATES FOR FERTILIZERS LISTED ARE AS FOLLOWS

Amount of Product to Apply Per 1,000 Sq. Ft. To Obtain Amount of Nitrogen Listed

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Fertilizer Analysis

	.5# N	1# N	1.5# N	2# N	2.5# N
5-4-0	10 Lbs.	20 Lbs.	30 Lbs.	40 Lbs.	50 Lbs.
6-3-0	8.3	16.6	25	33.2	41.5
6-6-6	8.3	16.6	25	32.2	41.5
8-8-8	6.25	12.5	18.75	25	31.25
10-10-10	5	10	15	20	25
12-4-8	4.16	8.33	12.5	16.66	20.82
16-4-8	3.12	6.25	9.4	12.5	15.62
20-5-5	2.5	5	7.5	10	12.5
20-0-0	2.5	5	7.5		
33.5-0-0	1.5	3	4.5		
45-0-0	1.1	2.2	3.3		

In addition to straight fertilizers, there are also a number of fertilizer-pesticide combination products that are available for use on turf grasses. These products are regulated by the Florida Fertilizer Law and only those combinations that have been approved can be offered. The Law limits the amount of pesticide that can be included in a mixture and requires that a caution statement appear on the label for the product. The directions for use must also be in line with federal and state recommendations. If the mixture will be sold across state lines, then it must also be registered in each state where it will be sold as well as in Washington (federal), and must comply with all state and federal regulations as far as labeling and use is concerned.

Presented at the 17th Annual FT-GA Conference by Ralph F. Jones, Specialty Products Manager, Wilson & Toomer Fertilizer Co., Jacksonville, Florida. ■

Lofts Presents Rutgers $65M In Royalties

Bound Brook, NJ — Lofts, Inc. recently awarded Rutgers University royalties totalling more than $65,000. Jon Loft, Lofts President and Chairman of the Board, presented the check at the 1984 Rutgers Turfgrass Field Day. The check was accepted on behalf of Rutgers University by Dr. Lowell A. Douglas, Chairman of Rutgers' Department of Soils and Crops.

Mr. Loft credited the unusually high royalties to the increased demand for high-quality turfgrasses. The check represented royalties on 1983 harvested turfgrass seed developed by Rutgers University . . . including RAM I and Mystic Kentucky bluegrasses; and five perennial ryegrasses — Palmer, Repell, Diplomat, Yorktown and Yorktown II.

Royalties play a vital role in the research and development of new turf varieties. Through the marketing efforts of companies like Lofts, these improved varieties are made available for commercial and public use.

For additional information, please contact Lofts Inc., Bound Brook, NJ 08805. (201) 356-8700. ■