The Fertilizer and the Bag

By Oswald Schreiner, Bureau of Chemistry and Soils

There is some inside information to be gained from a study of the fertilizer bag. An enormous number of fertilizer bags find their way to our American farms, estates, and country clubs annually, bringing products from far-away nitrate fields in Chile, potash from deep mines in Germany and France and from the lakes of our own western states, nitrogenous products from air fixation plants in Germany and Norway, phosphates from our own mines in Tennessee, Florida, and elsewhere, to say nothing of the nitrogenous products of our coking industries, our leather and wool industries, our slaughter houses, and our cottonseed oil mills. There are nearly 100,000,000 of these fertilizer bags annually, nearly one for every man, woman, and child in the United States. These bags carry 7,500,000 tons of fertilizer to aid in producing the crops to feed the Nation and creating the products of our commerce and our industries. Laid end to end these bags would stretch twice around the world, or, placing them side by side, would pave a highway broad enough for four automobiles to drive abreast across the United States.

By the fertilizer laws of the states, each bag bears certain definite information, either on a tag or, more often, stamped in large letters on the bag itself. There is, for instance, the weight of the fertilizer in the bag, usually "167 pounds," stamped on it; that is, 12 bags to the ton. This gives you a chance to check the weight of the shipment. Do you do it?

What probably attracts our attention first is the so-called brand name on the bags—"Potato Special," "Mammoth Producer," "Unexcelled Tobacco Fertilizer," and similar trade names—advertising bunk, which more often than not misleads the uninitiated, and confuses and confounds the farmer, the gardener, and the greenkeeper in selecting the fertilizer to meet his needs. For instance, the list of fertilizers offered for sale in a single state shows no less than 400 different brands. That many of these trade names are meaningless, if not entirely misleading, is shown by the fact that many so-called special crop brands vary widely in their composition and their formulae. A specific instance is the offering of three potato specials by the same firm, a 7-6-5, a 4-8-7, and a 2-9-3 formula. The great multiplicity of these trade names is being reduced, and it is to be hoped that they will eventually pass entirely away in the course of the progress which the industry is making.

The user of fertilizers can not depend upon the trade name to aid him in the selection of his fertilizers, but must learn to look at the composition given on the bag. Besides the brand name, there is also prominently displayed on the bag the name of the manufacturer. It is needless to say that this is real information. A trade reputation for high-grade products, good materials, uniformly satisfactory results, fair dealing, and honest treatment, is the highest asset of any manufacturer, and worth more than any fancy trade or brand name.

The most important thing on the bag is the guarantee required by law. This statement gives the real value of the fertilizer in the bag. It states the actual amount of active plant food the bag contains. It gives to the initiated the composition of the fertilizer and enables him to judge therefrom for what crops he can use it, what amounts he might apply per acre, and what the money value of what

he buys ought to be. This guarantee states, for instance, that the analysis of the fertilizer in that particular bag is as follows: ammonia, 5 per cent; available phosphoric acid, 8 per cent; and potash, 7 per cent. Such a fertilizer is known as a 5-8-7 formula. It means that in every 100 pounds of fertilizer there are 5+8+7=20 pounds of active plant food. Such a fertilizer would be called high grade. Let us look at another bag. Here is one that has a brand name of "Grain and Grass Special." That means nothing. Let us look for the guarantee. Here it is: ammonia, 1 per cent; available phosphoric acid, 8 per cent; potash, 1 per cent; a total of only 10 pounds of plant food in every 100 pounds of fertilizer. This is distinctly a low-grade fertilizer. It will sell cheaply as a bag full of fertilizer, but it is mighty high for the plant food it contains. Each percentage of plant food means 20 pounds per ton, and this amount is spoken of in the trade as a unit, and the price quotations are based on this unit. Now if we know the price per unit of each of the plant foods we can easily calculate the relative costs of two such fertilizers. The low-grade will be found to be the most expensive.

The consumer has to pay just as much freight on the low-grade goods as on the high-grade; and every other operation, such as hauling and handling, is greater on the low-grade than on the high-grade, as it takes more bags to get the same amount of plant food. For this and other reasons the fertilizer manufacturers and the agronomists of the state agricultural experiment stations and of the United States Department of Agriculture got together a few years ago and thoroughly thrashed this matter out. They decided that any fertilizer less than 14 per cent plant food should be called low-analysis fertilizer, and above that, high-analysis fertilizer, and that in the interest of the farmer, high-analysis fertilizers were to be manufactured and offered for sale as fast as farmers could be made to see that their best interests were served thereby. Sectional meetings are held, and it has been found that instead of hundreds, if not thousands of formulae, a comparatively small number, a dozen or two for each section, can be made to supply the farmer's needs for every crop and every soil. This movement is simplifying his problems greatly and enables his county agent, his state experiment station, and the fertilizer manufacturer or agent to advise him more accurately and definitely as to his requirements.

There are no Federal laws on interstate shipments, but the farmer is fully protected by the laws of his own state. In each state there are fertilizer control officials, who sample the various shipments offered for sale, analyze the same in the state laboratories, and publish annually a report of these analyses, giving the manufacturer a report of their findings, together with a money value of the fertilizer based on their analysis. Do you get this report from your agricultural experiment station or department of agriculture? If not, send for one. It will give you valuable information about the fertilizers offered for sale in your state. The analysis stated on the bag must by law be vigorously adhered to by the manufacturer. If found below the guarantee, action is taken against the fraudulent dealer. Such actions, however, are rare, because shortage is not often found. The fertilizer manufacturer protects himself more often than not, by having a slight "overage," that is, giving even a little higher analysis than is guaranteed. The farmer's interests in these and other matters is carefully guarded by these official chemists, who meet once a

year, usually in Washington, D. C., to discuss and perfect the methods used in this and other control work. The Association of Official Agricultural Chemists has standing committees always at work, perfecting the methods, examining new material, developing new methods. This control work, together with the field tests by the agronomists and fertilizer experts of the state agricultural stations and of the United States Department of Agriculture, is continually giving more and more accurate information regarding the fertilizer requirements of the different crops and soils of the United States.

So much for the outside of the bag with its formula and its guarantee. On the inside of the bag is the fertilizer itself. Take the fertilizer in the first bag, the so-called "Potato Special," with its 5-8-7 formula. The 5 per cent ammonia may be derived from nitrate of soda, sulphate of ammonia, fish scrap, tankage, cottonseed meal, or other products. The first two are known as inorganic sources of ammonia or nitrogen; the last mentioned are called "organics," and are lower in nitrogen content than the inorganics. A good fertilizer usually contains some of all of these, for the reason that the nitrate of soda, being very soluble, gives a quick start; the sulphate of ammonia is next in availability, being changed by soil organisms to nitrate in a short time. The organics are not so quick, but slowly give their nitrogen to the plants and thus keep up the plant food supply over a longer period. Thus all these different kinds of nitrogenous materials play their part, and the proportion in which they should occur in the fertilizer depends somewhat on the character of the soil and the crop to be grown, whether the soil be light or heavy, leachy or retentive of moisture, whether the crop be one with a short or long period of growth, whether grown mainly for foliage, for root, or for seed or fruit.

Of the three plant foods, nitrogen, phosphate, and potash, the nitrogen is the most expensive, costing several times as much as the phosphoric acid or the potash. Consequently the percentage of nitrogen in a fertilizer, especially if the source of the nitrogen is from high-priced organic materials, controls the price; and the higher the nitrogen, the higher will be the cost of the fertilizers. In turf work, where nitrogen is so essential for vegetative production, the cost of the nitrogen raises the cost of the fertilizer as a whole. A high-phosphate fertilizer, although having a high-grade rating, may sell for less than one containing a high-nitrogen content better suited for turf.

Potash is usually supplied in fertilizers in high-grade salts, such as the muriate and sulphate, analyzing 50 per cent potash, or in the form of manure salt, a mixture of many crude potash salts and of Kainit, a similar mixture of lower potash content.

These various fertilizer materials and salts are mixed in the proper proportions to give the desired analysis or guarantee as stated on the outside of the bag. When the mixed materials do not amount to a ton, some inert filler, such as sand, peat, or the like, must be added to make the proper formula. It is obvious that this filler material is undesirable for economic reasons, and so the manufacturer avoids it as much as possible by using low-analysis materials to make his mixtures of low-analysis fertilizers. The higher the analysis, the less filler is required, and the more concentrated will be the fertilizer in plant food materials. The fillers, and also the organics of low or high analysis, have the effect of making the fertilizer more resistant to

unfavorably wet or dry conditions, prevent caking or hardening of the fertilizer mass, and so make for greater ease in distributing the fertilizer either by broadcasting or by special distributing machinery. Without fillers, or organics, the fertilizer mixtures are more apt to get moist and set, and much greater care is necessary in preparing and storing them. For this reason, low-analysis fertilizers are more fool-proof and safer to use. The higher the analysis, the greater care and scientific information concerning the properties of the materials is required; but with this, greater advantages are derived by both fertilizer user and manufacturer—less material to handle, less bagging and hauling, and above all less freight to pay, so that the active plant food can be more economically put on the soil in the high-analysis fertilizers.

The fixation of the nitrogen of the air, and also improved methods of manufacture in phosphate fertilizers, are now making the production of really concentrated fertilizers possible, so that four or even three bags will contain as much plant food as twelve bags of the older formulae. Fertilizers containing as much as 40 or 60 per cent plant food are already on the market, and some compounds as high as 75 per cent have been manufactured. These concentrated products of the chemist's skill bring with them new problems in fertilizer usage and distribution, but they hold forth much promise of greater economic application and lower cost of fertilizer with increased benefits.

Renovating the Fairways of the Algonquin Golf Club

By A. J. Goetz

The course of the Algonquin Golf Club, at Webster Groves, near St. Louis, Missouri, was laid out in its present location about 1904. The fairways are rolling. The soil is a residual limestone, grading from a fair clay loam to yellow clay. The native vegetation is mostly post oak, red oak, and elm. Tests of these soils in 1925 showed them to be very acid—not a natural bluegrass soil, by any means. The turf is a mixture of Kentucky bluegrass, annual bluegrass (*Poa annua*), redtop, some white clover, bent grass, and rough-stalked bluegrass (*Poa trivialis*), the Kentucky bluegrass predominating.

The fairway program, before I took charge in the fall of 1925, was to seed in the spring and fall and apply stable manure in the winter. No commercial fertilizers were used. More than $10,000 was spent for seed and manure during the four years preceding my time, but even the best areas had only a thin, sickly stand of bluegrass. Crab grass, goose grass, dandelion, dock, plantain, and chickweed were much in evidence.

In the spring of 1926 a series of fertilizer tests was conducted with sulphate of ammonia, nitrate of soda, bone meal, acid phosphate, muriate of potash, and lime. These fertilizers were tested both alone and in combination, the results being observed carefully and the comparative costs figured.

In July, 1926, 4,000 pounds per acre of finely ground limestone was applied to all the fairways. About the first of September the fairways were seeded with 40 pounds of bluegrass and 10 pounds of redtop per acre. As soon as this seed was up well, about the first of October, 400 pounds of raw ground bone and 125 pounds of sulphate of