

siderable value as a constituent of putting greens in these situations.

Hard Fescue

Perhaps the best known of British fescues and particularly valued for its power to stand constant wear. For this reason it is often seen on British tees. Mingled in due proportion with other sorts, it is present to some extent on putting greens in Britain, but is not nearly so widely distributed as red fescue or sheep's fescue.

The leaves of hard fescue are generally stouter and are of a bluish green color, as distinct from the other fescues.

Wavy Hair Grass

A species often present in abundance on the drying heathlands of Britain, where it contributes to the formation of a really excellent turf. To the casual observer wavy hair grass appears indistinguishable from the fescues, but the presence of a well-developed ligule is sufficient to identify this grass, as in the case of the fescues the ligule is much reduced or entirely absent.

But for the fact that it germinates very indifferently seed of wavy hair grass would be in great demand for sowing on British golf courses.

Crested Dogtail

An important constituent of the turf on the chalk soils of Britain. It sometimes appears in putting greens and forms a compact turf, provided the ground is well filled with the plants and they are more or less crowded together. Crested dogtail, however, is essentially a fairway grass, as the leaf blades are somewhat wide. Like hard fescue it will stand a lot of wear and is a grass that is valuable for tees.

The foliage of crested dogtail is compact and remains green for an unusual time in the absence of rain. The roots are capable of penetrating the soil to a considerable depth and the plant is well adapted for the dry chalk loams upon which it is commonly found.

Smooth-stalked Meadow Grass

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coarse and would, therefore, find favor as a constituent of putting turf. Smooth-stalked meadow grass, however, is not found to any considerable extent on British greens as very close cutting does not appear to suit it and it suffers in consequence from competition by the rather more suitable bents and fescues.

Rough-stalked Meadow Grass

Is somewhat similar in appearance to smooth-stalked meadow grass, but instead of being adapted to dry, light soils it flourishes in strong, moist situations. On British fairways where the soil is at all heavy, rough-stalked meadow grass forms a useful constituent of the herbage. In color it is particularly bright and green, invariably looks fresh and has the merit of flourishing under trees or in shady spots.

With smooth-stalked meadow grass, it shares the dislike of being very closely mown and is not, therefore, seen to any great degree on British greens.

Wood Meadow Grass

Shares with rough-stalked meadow grass a taste for shady situations and is, therefore, found to some extent on British greens which do not enjoy much sunshine. The foliage is particularly fine and of a perpetual greenness.

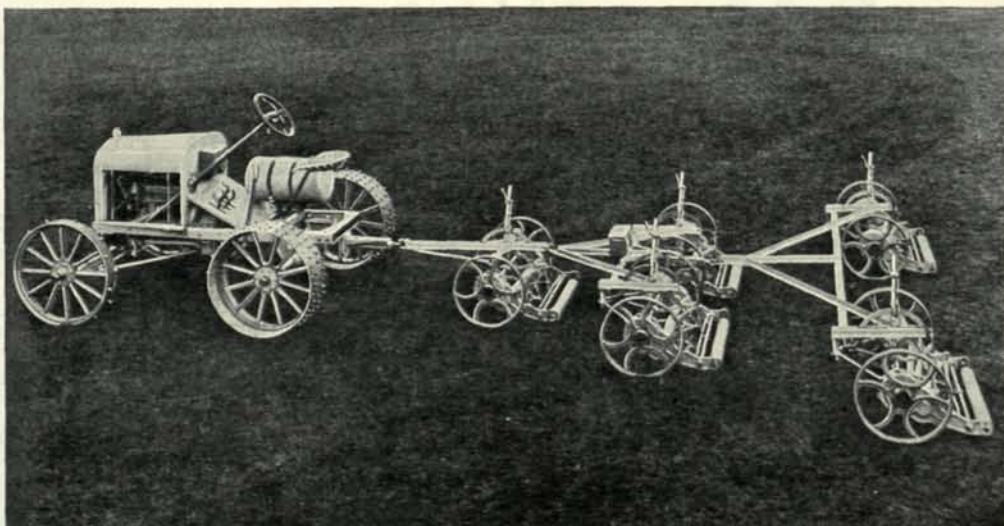
Annual Meadow Grass

This species is usually looked upon as a troublesome weed, but in situations where other grasses do not thrive annual meadow grass often forms the bulk of the herbage on British greens. While it is only a short-lived variety, it is capable of maintaining a turf by reason of its remarkable power of seeding at almost every period of the year.

Annual meadow grass is not altogether to be despised as with a little extra care and attention it is possible to make good greens of it, even if the turf is rather sensitive to weather conditions. It must be confessed, however, that annual meadow grass is rather more widely distributed in British greens than is really de-

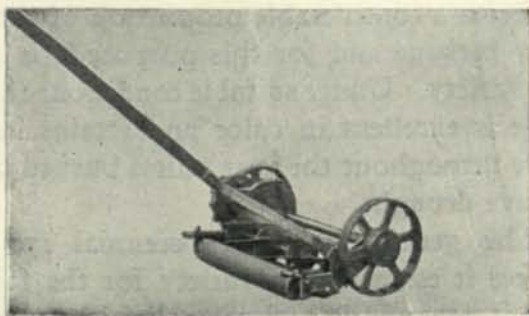
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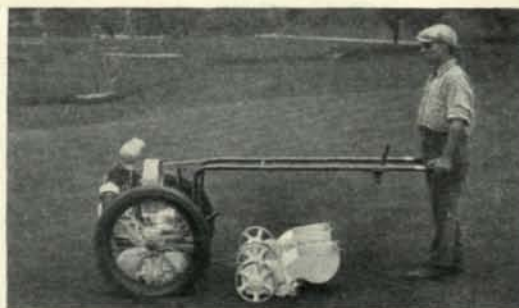


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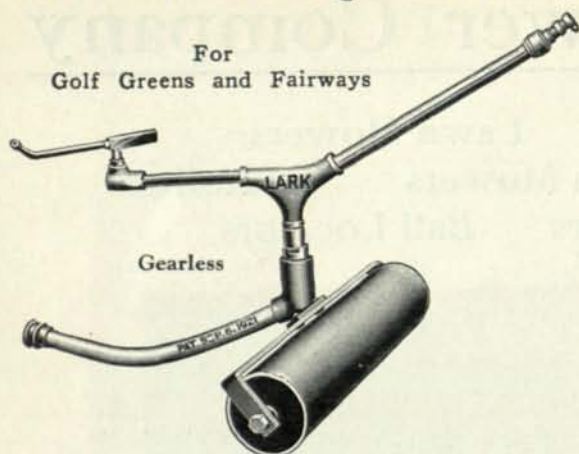
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sirable and often this is due to mismanagement as much as poor soil conditions.

Perennial Rye Grass

Perennial rye grass is perhaps the best known British grass, if not the most widely distributed on English courses. On loam or clay soil it forms a considerable proportion of the fairway herbage and for this purpose it is a useful variety. Under suitable conditions the herbage is excellent in color and retains its verdure throughout the year unless burned by excessive drought.

The general habit of perennial rye grass makes it essentially a variety for the fairway and it never finds a place on British greens.

The divergence of opinion which exists as to the merits of perennial rye grass for British fairways is undoubtedly due to the extraordinary variation in the habit of this plant according to the class of land upon which it is sown. On certain soils perennial rye grass gets quite out of hand and exhibits an objectionable tendency to coarseness, which makes it unsuitable even for fairways.

Animal vs. Chemical Fertilizers

By VICTOR GEORGE, *Greenkeeper*
LaFayette (Indiana) Country Club

Read at the Third Annual Convention of the National Association of Greenkeepers of America at Hotel Statler, Buffalo, February 13-15, 1929.



VICTOR GEORGE

WHEN I received an order from our worthy President, Mr. Morley, to read a paper to the members assembled here on the subject: "Animal vs. Chemical Fertilizers," I accepted it quite cheerfully.

In fact, I always obey orders from my superior officers, and in connection therewith, if I may be so bold, I wish to relate an experience, which I had in the German Army, and after listening to the same, I am sure you all will agree with me, that it is much better and wiser to volunteer and to obey, than it is to hold back.

In 1898, while serving in the German Army, the Boxer Rebellion broke out in China, during which revolt several Ambassadors from different countries were killed, in consequence thereof the civilized nations of the earth declared war on the warring Boxer element in that country.

This being an International affair, the German soldiers, under the German Constitution, could not be commanded or compelled to go to China to fight the Kaiser's battles. However, the Colonel of the regiment, in which I served, was expected to furnish his quota of volunteers, and so called for these. So one fine morning, while we were lined up for parade, the old Colonel came riding down the street and greeted us with his usual gruff "Good Morning, Regiment!" We answered as usual

also: "Good Morning, Colonel!"

After this formal greeting he made us a wonderful speech, telling us all about the trouble in China, and then called for volunteers. To our shame it must be admitted, no one responded. The old gentleman again called "Volunteers for China, 3 steps forward, march!" But with the exception of all the officers, apparently nobody heard his appeal. The Colonel called the officers and had a private talk with them; the officers returned and talked to the non-commissioned officers.

Without calling for volunteers again, the Colonel shouted the order: "Front line, 3 steps forward march." The non-commissioned officers lined up behind the soldiers and for the third time the Colonel called: "Volunteers to the front!" Just then I received a kick in the place which is highest when I stoop over, and I fell out of line and so was hailed as the first one to volunteer to go to China.

Now, I doubt whether our good President would stoop to so low a trick as that, but in order to deprive him of this chance, I accepted his command; and now I find that I have quite a job on hand.

Purdue Professors Help

HOWEVER, I am glad to state, that I have had the assistance of such men as Professor A. T. Wiancke and Professor S. D. Conner of Purdue University of Lafayette, Indiana, and combining their knowledge with my own experience I may be able to hold your attention for a short time to submit my paper to your careful consideration.

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our natural or so-called animal fertilizers, chief of which of course is stable manure. There was a time when we could not, or at least thought we could not, do without it. Now comes the claim that this is a breeder of brown patch fungus, and we all admit the possibility of this claim. And also there is no doubt that many weeds are carried on the greens by this method. Yet we still make good use of it in our compost.

My main objection to this kind of fertilizer is its low content of insoluble nitrogen.

In spite of the many solid objections to the use of manure, I have been using it in compost piles for many years and think it would be difficult to get along without. Also, a compost pile without manure is unthinkable to me.

I always start my pile from two to three years in advance of its use, thus giving the manure plenty of time to decompose or rot, and also keeping the weeds off the pile, turning it over at least twice a year with a slip scraper and not making it higher than three feet; and when the time comes it is in splendid condition.

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compost by plowing and fertilizing a plat of ground is very good and I am sure he is using stable manure to some degree. I used a special fertilizer which is supposed to be used without composting on the greens, and whose producer makes the claim that you will not be troubled with Brown Patch if his product is used according to directions. I faithfully followed his advice on two of my greens, and while it surely is a complete grass food. I had bigger and bet-

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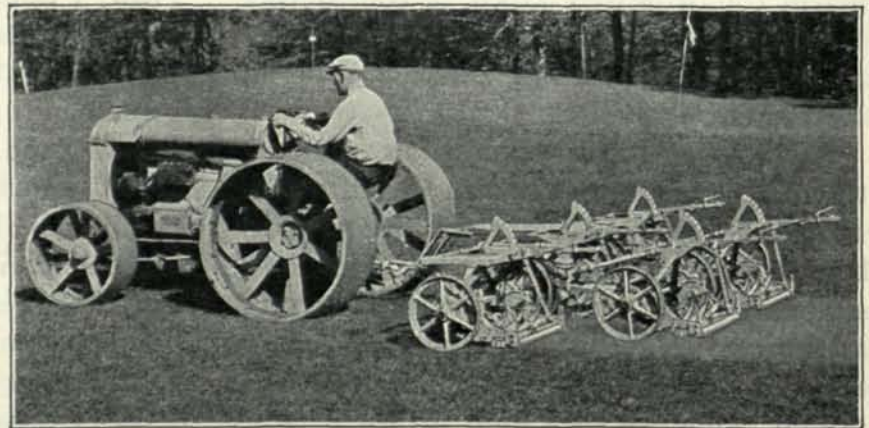
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ter Brown Patches on those two greens than on the rest of them.

Like stable manure, we still have use for other animal fertilizers such as tankage, bone meal, dried chicken and sheep manure, etc. But these are mostly used on new work, and when thoroughly incorporated in the soil, will do a world of good. But times have changed—these fertilizers are out of date; they are too bulky and hard to handle; they are too expensive per unit of grass food, too slow in action and like the farmer, we live in an age of chemical fertilization.

Fertilizers Vary With Soils

IBEG to quote Professor Wiancko: "Ten years ago the fertilizer industry through its soil committee, asked the Agronomists and Soil Chemists of the Agricultural Station to draw up recommendations covering the fertilizer needs under the various soil conditions in their particular states.

"Some replied that this could not be done; that there were so many factors involved that each particular case must be considered by itself. A few, however, had enough background in the results of the fertilizer experiments, on the principal types of soil under different systems of cropping, with and without the use of manure, that they undertook the proposition.

"Only high analysis fertilizers were recommended, and furthermore it was found that only about twelve different analyses were needed to meet the entire requirements, whereas at the time there were more than one hundred different analyses of fertilizer on the market in Indiana alone.

"It should be mentioned here to the credit of the fertilizer industry that the management of the activities of the Soil Improvement Committee of the National Fertilizer association, which undertook to serve as a sort of clearing house between the fertilizer industry and the Experiment Stations primarily interested in the welfare of the Greenkeeper, was now in the hands of soil men formerly connected with Agricultural Experimental Stations and Extension Departments and familiar with soil fertility and fertilizer problems.

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"Under the guidance of this committee and with the advice of the Experiment Stations the leaders of the fertilizing industry at once took up the proposals for a better fertilizing service and set about the big task of adjusting the manufacture and sale of fertilizer to conform to the needs for a higher analysis and better grades.

"There were many conferences after this, all striving to give us a better, less expensive fertilizer. In classifying as high grade or low grade, those containing less than fourteen units of plant food were called 'Low grade,' and those containing fourteen units or more were called 'high grade'.

"The tendency towards higher grade fertilizers and higher analysis, meaning more plant food per ton and lower cost per unit, is being more and more emphasized as higher grade materials are being developed and employed in the manufacture of fertilizer. We now get as much available plant food in one ton of fertilizer as we formerly got in two tons."

Inorganic Materials Preferred

AFTER giving you this little history of the fertilizer industries, and showing you the improvements so far made, I will again quote Professor Wiancko, and let him tell just why inorganic materials are better adapted for use in the manufacture of fertilizer than the organic materials.

"Besides the fact that low grade materials containing a small percentage of nitrogen cannot be used to any considerable extent in the making of high analysis fertilizer, the manufacturers have found it advantageous for other reasons to use higher grade carriers of nitrogen.

"One thing which has helped in this direction is the fact that most fertilizer inspection reports now distinguish the different grades of nitrogen contained in the fertilizer such as the water soluble organic and inorganic; the highest grades, active water soluble organic and inactive water soluble organic, which is the lowest grade. Many of the organic materials which have been used in the making of mixed fertilizers carrying small amounts of



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nitrogen contain too much of their nitrogen in the inactive forms. Such fertilizers are rightly claimed as low grade.

"Two other factors of major importance have entered into bringing about increased use of the more readily available inorganic carriers of nitrogen. One is the limited supply of high grade natural organic materials available for use as fertilizer, and the other is the greater and rapidly increasing supply of high grade inorganic materials at greatly reduced cost.

"The old idea that organic nitrogen is worth more than inorganic nitrogen in fertilizers is dying hard, but it should die because it has been known for a long time that it is a mistaken idea. Many experiments where organic and inorganic sources of nitrogen have been compared, have shown that the inorganic are superior.

"At the New Jersey Agricultural Experimental station comparisons of dried blood, fishmeal and concentrated tankage with sodium nitrate, calcium nitrate, ammonium sulphate and calcium cyanamid were made over a series of years. The efficiency of the inorganic nitrogen was found to be greater than that of the organic nitrogen.

"In summarizing some of these experiments in Bulletin No. 260, the authors say: 'The average recoveries with nitrates, ammonium sulphate and calcium cyanamid are distinctly higher than with the same amount of nitrogen in the form of dried blood, fish and tankage. According to this there seems to be no good reason why we should pay more per unit for the latter than the former.'"

All this seems to indicate that fertilizer used on our putting greens should be high in available nitrogen.

From green house tests on nitrogen materials it has been found that nitrate of soda and ammonium sulphate are the most quickly available of nitrogenous materials on the market. Dried chicken and sheep manure are sold, and as they contain some nitrogen they will do some good. But the price of dried manure per unit of ammonia is so high, that they do not do as much good per dollar invested as do fertilizers containing nitrate of soda and ammon-

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ium sulphate, which are, as we have seen, water soluble, and are readily available.

Nitrate of soda tends to reduce soil acidity and therefore should not be used on creeping-bent grasses. Ammonium sulphate in itself is not a complete fertilizer and should be combined with potash and phosphoric acid. These latter two chemicals, if used alone, do not give satisfactory results, but in combination with ammonium make a real fertilizer. The amount of the three different chemicals must be judged according to the needs of your soil.

In summarizing, I should like to say that the title of my paper would have been more satisfactory if it had read: "Organic vs. Inorganic (Chemical) Fertilizer". All animal fertilizers are organic, but are so similar to organic plant materials such as cottonseed meal, etc., that they may be discussed together.

Organic Fertilizers Widely Used

IN GENERAL, organic fertilizers have been used widely for two reasons: First, because they increase the humus content of the soil, and secondly, because they become available rather slowly after application, and, therefore, last a long time. There is, however, a great loss of nitrogen in the process of decay and reduced efficiency.

Inorganic fertilizers are used on account of their content of nitrogen in quickly available water soluble form.

You will find splendid discussions on these subjects in the following books, "Turf for Golf Courses," by Piper and Oakley; "Fertilizers," by E. B. Voorheese, and in the books on "Soils," by Lyon and Buckman.

I am sure that we all feel that in the present state of the art of greenkeeping we all have use for both organic and inorganic fertilization, but in general, we feel more at home with manure than with ammonium sulphate and other chemical fertilizer, and for that reason, we may be overlooking opportunities of improving our grass at low cost made possible by the fertilizer industry.

Next Month

"Fertilization of Fairways" by O. J. Noer, will be a feature article of the April number.