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of the

UNITED STATES GOLF ASSOCIATION GREEN SECTION

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Contents

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The Fairway Fertilization Problem

On a rapidly increasing number of golf courses the problem of fairway improvement is receiving far more attention than was considered necessary on even the best-kept courses a few years ago. Watering systems have been installed throughout the fairways on many courses, artificial drainage has been provided, and many other improvements have been brought about. Together with these many improvement there has been a general increase in fertilization programs. One of the fundamental requisites of good turf is an abundant supply of plant food in readily available form; and, consequently, if the fairways are to be improved, each club must sooner or later face the problem of applying fertilizers in some form.

Years ago the almost universal fertilizer for fairways was stable manure. Changes in recent years have so reduced the supply of this commodity that on many courses it no longer proves the most economical source of plant food. Furthermore, the increased demand for a prolonged playing season on many courses renders a heavy top-dressing of manure objectionable. Initial cost of material, cost of hauling, method of handling, speed of application, interference with play, influence on weed growth, and many other factors, have played an important part in bringing into general use new methods to replace those of only a few years ago. Like so many other golf course problems, that of the most desirable fertilizer for fairways will vary somewhat with the local conditions. It is the purpose of the current issue of THE BULLETIN to bring together a number of different methods at present in use throughout the country. No attempt will be made to pass judgment on any individual method; nor is it to be inferred that the collection of articles in this BULLETIN represents the best or all of the methods that prove effective. The articles do, however, serve to show that there are several means for securing the desired results; but in the final analysis these different methods are in many respects similar.

In general, it will be observed that there is a growing tendency to turn to the more concentrated fertilizers. These reduce transportation costs, are more rapidly and easily distributed, and do not interfere with play. As a general rule, some complete fertilizer is used, but invariably the nitrogen content is high or the ratio is raised by the addition of a high-nitrogen fertilizer. On fairways where bluegrass abounds it is not desirable to increase the acidity of the soil to the same extent that is sought on greens, where the more acid-tolerant grasses, such as bent, predominate. On the other hand, it may be desirable to use fertilizers which increase the acidity of the soil if clover and other weeds are abundant. This may be especially advan-

tageous on fairways where bent turf is common. How far one may safely go in increasing soil acidity without injuring bluegrass turf is still a disputed question, although, in general, from fairway fertilization practice throughout most of the country, it is probable that any bad effects of acidity would be overbalanced by the advantage of having a less weedy turf. In any case, if such a condition in particular localities is found to be harmful, it can readily be overcome with light applications of lime.

In buying fertilizers cost is an important factor. The many fertilizer laws adequately protect the public, provided the public is interested enough to avail itself of the information at hand. In order that clubs may understand more clearly what information is at their disposal in purchasing fertilizers, we are publishing the following article by Dr. Schreiner, who is in charge of the soil-fertility work of the United States Department of Agriculture, and, consequently, well qualified to give advice on this subject. In his article Dr. Schreiner points out that greenkeepers or green committees who buy fertilizers blindly have only themselves to blame. The fertilizer business, of course, is based chiefly on the demand in ordinary agricultural production. Nevertheless, the same laws that protect the farmer protect golf clubs, if they choose to avail themselves of this protection.

We wish further to emphasize Dr. Schreiner's statements concerning the relative cost of nitrogen and the other elements used in fertilizers. We repeatedly are advised of attempts by some fertilizer companies to dispose of low-grade fertilizers, or fertilizers unsuitable for turf, at fancy prices. Many of these attempts are due to misinformation. The fertilizer business is based on farm crop production. In farm practice it is desirable in most cases to produce seed or fruit, with much less emphasis on purely vegetative production. Since nitrogen is most effective in producing leaves and stems, it can be easily overdone in fertilizing crops intended for seed production. We have not heard of a golf course trying to produce a crop of seed on its fairways, but we do know of many which are trying to increase the production of grass leaves. Therefore all the experimental work and sales literature on increased crop yields are not necessarily applicable to turf production. In addition to the danger of excessive vegetative development, due to large amounts of nitrogen, in producing farm crops, the relatively high price of nitrogen in a fertilizer has tended to discourage fertilizer manufacturers from putting out mixtures with a high nitrogen content. As is shown in the accompanying articles, golf clubs are overcoming this disadvantage by insisting on a relatively high-nitrogen mixture, such as is referred to by Mr. MacGregor, or by using some other fertilizer and increasing the nitrogen content with a strictly nitrogenous fertilizer such as described by other writers in this BULLETIN. In many farm crops phosphorus and potash are needed in large quantities, but in turf culture it is probable that much of the phosphorus and potash is wasted.

Fertilizers, in addition to furnishing plant food, may also carry organic material, which serves to improve the physical condition of the soil. Stable manure is perhaps the best fertilizer for this purpose; and where stiff clay or other poor areas of a fairway are to be improved, it will often be found desirable to use manure, rich loam, or organic fertilizers with much bulk. Such materials should

preferably be worked into the soil wherever the procedure is feasible; but even when applied on the surface they produce great improvements. On well-established fairways, concentrated fertilizers can be used to advantage, for in such cases the problem of supplying organic material is negligible, since the grass clippings left on the turf constantly replenish the supply of organic material.

In the accompanying table we list in tabular form a number of fertilizers used on fairways, and give the approximate percentages of nitrogen, phosphoric acid, and potash contained in each. It is hoped that such a list may prove of value if used in conjunction with price quotations available in different localities. These figures are only approximate in the table; but any reputable firm will gladly furnish the exact analysis of its product for comparison with other mixtures on the market. Frequently the analyses of some fertilizers will show ammonia content instead of nitrogen. This need not be confusing if it is remembered that only four-fifths of ammonia is nitrogen.

FAIRWAY FERTILIZERS

APPROXIMATE PERCENTAGE OF NITROGEN, PHOSPHORIC ACID, AND POTASH CONTAINED IN EACH, AND ITS RATE OF APPLICATION IN POUNDS (OR TONS, WHERE INDICATED) PER ACRE

	Nitrogen	*Phosphoric acid*	*Potash*	*Rate of Application* *Topdressing*	*Construction*
Urea	46	.....	....	60–90	60–75
Nitrate of ammonia	35	.....	....	75–120	75–100
Calurea	34*	.....	....	75–120	75–100
Sulphate of ammonia	20	.....	....	125–200	125–150
Nitrate of soda	16	.....	....	150–225	150–175
Ammo.-phos., 1st grade	17	20	....	150–225	175–225
Nitrophoska	15	30	15	150–225	150–225
Nitrate of potash	14	.....	44	150–225	150–225
Ammo.-phos., 2d grade	11	48	....	185–275	200–275
Cottonseed meal (75%) and sulphate of ammonia (25%)†	10	2¼	1½	400–600	600–800
Dried meat meal	10–14	3–4	....	300–400	400–600
Fish scraps	6–9	5–10	....	400–500	500–700
Lecco	7½	5	2	350–500	350–500
Cottonseed meal	6	3	2	400–600	600–800
Soybean meal	6	3	2	400–600	600–800
Milorganite (activated sludge)	5½	2½	½	400–600	600–800
Castor bean pomace	5½	2	1	400–600	600–800
Tankage	4–12	6–20	....	400–600	600–1000
Bone meal	3–5	18–20	....	500–1000	1000–1500
Pulverized poultry manure	2–3	1.6	.8	800–1200	1200–1500
Pulverized sheep manure	2–3	1	2–3	800–1200	1200–1500
Pulverized tobacco	2–2½	½–1	3½	1000–1500	1500–2000
Compost	1–2	½–1	1–1½	3–5 tons	8–20 tons
Well-rotted manure	1	½	1	8–10 tons	10–30 tons
Mushroom soil	1	½	1	6–8 tons	8–25 tons
Fresh manure	½	¼–½	1–1½	15–20 tons	20–40 tons

* Also 14% lime.

† Often sulphate of ammonia is added to organic fertilizer so as to obtain quicker results. In this way also considerably more nitrogen may be applied at one time without fear of burning the turf or excessive loss by leaching.

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

ammonia were applied to all the fairways with the exception of three where nitrate of soda was used in place of sulphate of ammonia. On these three fairways nitrate of soda had been used all along, while on the others sulphate of ammonia had been employed. After two years I can see no difference on these areas with regard to quality of turf and weed control. However, it cost considerably more to apply a given amount of nitrogen in nitrate of soda than in sulphate of ammonia. In all cases, as the grass thickens the weeds become less evident.

About the first of April, 1927, 300 pounds of cottonseed meal and 125 pounds of sulphate of ammonia were applied per acre. In early May this was followed with 500 pounds of activated sludge and 125 pounds of sulphate of ammonia. Again, in September, 400 pounds of raw ground bone meal and 125 pounds of sulphate of ammonia were applied. In April, 1928, 600 pounds of sludge and 200 pounds of nitrate of soda were used on about one-half of the course, and 600 pounds of sludge and 200 pounds of calcium nitrate on the rest of the course. These fertilizers were employed inasmuch as there was no sulphate of ammonia available at the time.

All these fertilizers were applied with a lime sower drawn by a tractor. This lime sower is designed for spreading large quantities of material, and will not apply small quantities satisfactorily. I now have a machine in view which I think will apply smaller quantities, so that it will not be necessary to make up so much bulk. I plan to depend on sulphate of ammonia with just sufficient filler to facilitate application. I think our fairways have enough phosphorus for some time to come.

The clay slopes were given about one extra application of these fertilizers approximately once a year. I plowed up several packed areas and one clay hill last fall and worked into the soil from 25 to 50 tons per acre of manure, depending on the condition of the soil. I then planted them with creeping bent, and we now have a splendid turf on these areas, where we failed to get grass started by seeding.

With regard to our tees, some are creeping bent, others were sodded with Kentucky bluegrass, and last fall some were seeded with rough-stalked bluegrass and redtop. They are fertilized about once a month with sulphate of ammonia, which is applied either dry or in solution, depending on circumstances, the solution being applied by the barrel method.

None of our fairways are watered, except those areas planted with creeping bent last fall, where it was necessary to water the stolons until they became established and were growing well. I doubt if it would be wise to water bluegrass fairways in this section, even though the cost were not prohibitive, as it is here. The watering of bluegrass during its dormant stage, which lasts for ten or twelve weeks, appears to result merely in a dense growth of crab grass, which is not at all desirable. I believe it is better to let nature take its course. Kentucky bluegrass seems to come back stronger than ever after a period of drought. Crab grass, however, will cause great damage by smothering turf unless it is cut very close and prevented from forming runners.

The improvement in our fairway turf during the past two years has been truly wonderful; and now that the fairways are in good condition, I am sure that the cost of keeping them so will be much less than the cost of building them up again.

Fairway Treatment at Mayfair Golf and Country Club

By Y. K. McClenahan

Owing to a rather limited staff of workmen we have not been able to do much in the way of top-dressing our fairways here at Edmonton, Alberta, but the results of what we have been able to do on our approaches have certainly repaid us amply. The redtop and Kentucky bluegrass turf of our fairways is now six years old. Our soil is sandy, and our fairways are not watered. Three years ago we top-dressed our approaches with compost, using a wagon and spreading the compost with shovels. Last year we included also sulphate of ammonia in our fertilization program, and as our fairways are not watered we had to take advantage of rainy days to make the application. It then took the entire staff to broadcast it by hand. We have recently, however, procured an end-gate lime spreader for the purpose, and by this means are able, with two men, to make a much quicker and better application of the sulphate and compost. The lime spreader is drawn by a team of horses, one of the men driving the team and the other feeding the hopper. The compost is dragged with a chain harrow after it is spread, so that scarcely a trace of the compost is noticeable and play is interfered with not in the least. It has been our experience that even a few days after the application of sulphate of ammonia a distinct benefit to the turf can be seen. I might add that by adjusting the feed this spreader can be used also for seeding. We use a rotary screen for preparing the compost top-dressing for our greens, the coarser material (passing through the lower half of the screen), being used for top-dressing the approaches.

Fertilizing fairways with a horse-drawn, end-gate lime spreader.

Our tees are treated the same as the greens, being top-dressed every third week. We have some trouble from winterkilling, but in such cases the dead turf is raked over, seeded, and top-dressed, and when the young grass is established it is fertilized with sulphate of ammonia.

I am afraid we have not been using compost and sulphate of ammonia here long enough to check the growth of weeds. All of our approaches, however, have a far better turf than the rest of the fairways, which have not been treated; and it is quite probable that if a regular fertilization program can be followed for our entire fairways, within the next five years very little of the weeds will remain.

Visibility is the first requisite for the ideal golf course. A player should be able to see what he has to do, golf being a test of skill and not guesswork. The second requisite is fairness.

Annual Summer Greenkeepers' Meeting Held June 4 to 6

Mother Nature gave further proof of her custom of supplying elements for the greenkeeper to combat, by sending rain and mist to Atlantic City on the morning of June 4. Despite the disagreeable weather, however, many golf course enthusiasts were on hand. The Country Club of Atlantic City played host, and the course provided entertainment in the morning for those who cared to play. After lunch Mr. H. Kendall Read, chairman of the Green Committee of the club, guided the convention over the course of which he is justly proud.

Special attention was given to the natural use and effects gained with the sandy and gravelly seaside soil. Although the terrain is flat, the architecture and construction of the course were so well worked out that, by accentuating natural contours, it appeared as a naturally rolling terrain. Beautiful effects were gained in the construction of the putting greens by large shallow bunkers, tilted putting surfaces, and long slopes from every elevation. Large areas of sandy waste, with bunches and tufts of coarse marram grass here and there, accentuated the seaside effect and were made to look windswept and natural by the manner in which the sand appeared to have drifted and by the rough, naturally overhanging turf on the lips of the traps.

While going over the course, turf building and maintenance methods were pointed out and discussed besides the construction problems. One striking point was the excellent turf that has finally been procured on what was once a barren sand and gravel waste. The new district experimental plots which have been laid out on Mr. Read's course by the Green Section came in for a good share of interest and discussion. Before dinner the meeting spent an interesting hour examining the water plant and sewage disposal system, both of which are perhaps the latest things in that line.

Dinner was served in the club, and an informal discussion kept the ball rolling during the evening.

On Tuesday, June 5, the convention arrived at the famous Pine Valley Golf Club, near Philadelphia. Some of the more daring played golf, but for the most part the members of the convention were content to admire the tremendous carries, the bold bunkering, the fine turf, and the natural and picturesque scenery of the whole grand layout.

Wednesday found that the convention had gathered some new faces, notwithstanding a few of the attendants had left. In any event the interest was very keen at the Green Section's turf garden at Arlington Farm, which was the attraction for the final day. The numerous plots were clearly outlined with cord boundaries, and signs were plentifully placed, so that comparisons and results were easily made and seen. The research work was explained by the members of the Green Section. Turf of various varieties, fertilizers, soil acidity, turf diseases, putting surfaces, arsenate of lead, annual bluegrass (*Poa annua*), maintenance, rate of seeding, height of cutting, seasonal differences in strains and varieties, and disease-resistant varieties, were among the many phases of work that the Green Section had on hand for those interested.

Gentle slopes are desirable. Sharp banks on which a ball can not stop are certainly undesirable.

Fairway Treatment at Baltusrol

By R. Avery Jones

The Baltusrol Golf Club, at Short Hills, New Jersey, has two courses. Five of the fairways on the present course were part of the original Baltusrol course, and they are about thirty years old. Six of the other fairways are on ground that had been cultivated or cropped for hay. The remaining portions of the two courses are built on what was a wooded foothill over which all the surface water of Baltusrol Mountain had flowed for generations. The soil on the upper course is clay, with numerous small areas of gravel mixed with a very fine red sand, such as brass moulders use. The lower course is stiff clay. In the oldest fairways velvet bent predominates, and in the new fairways this desirable grass is increasing rapidly.

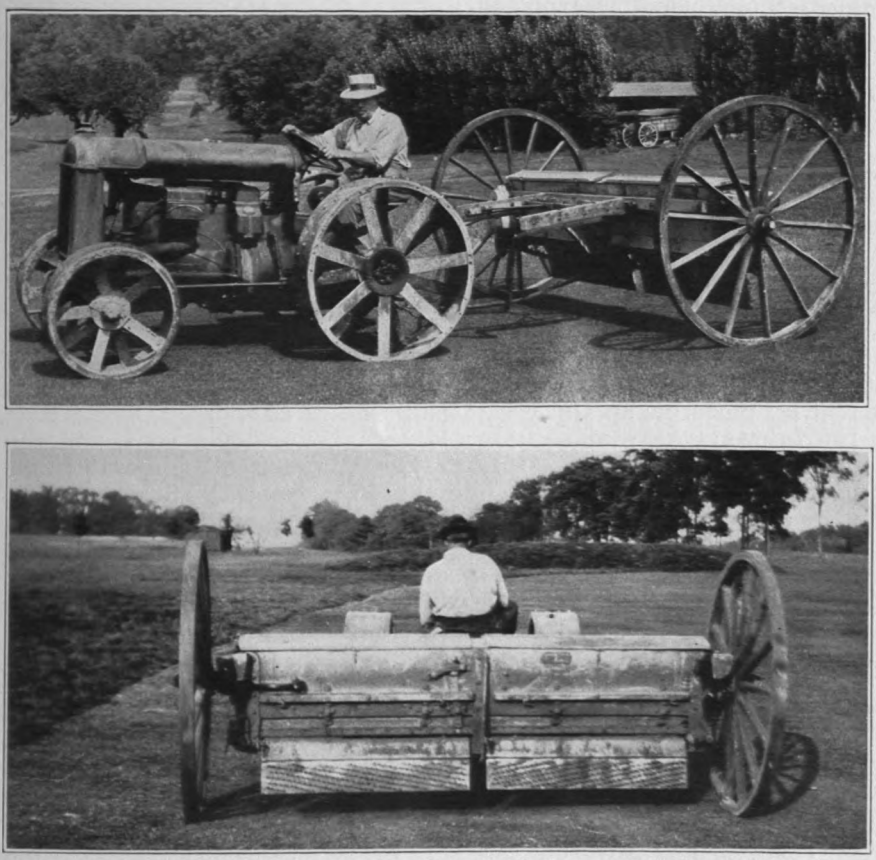
When the change from an 18- to a 36-hole course was made, nine years ago, red fescue was used liberally; but the soil proved unsuited to this grass at that time. Though hardly discernible five years ago, the red fescue is now however showing up rapidly and thriving, due no doubt to the use of fertilizers having the proper reaction.

In 1923 winter rules were played, for fairways were poor. During the winter of 1924 about 1,000 tons of fresh cow manure and 2,000 tons of soil were applied to the fairways. The soil was taken from a nearby field of about six acres. This field had been dressed with 100 tons of barnyard manure early in the fall of 1924, and the ground plowed, replowed, and disked several times. During the winter this soil was taken to the fairways and spread, the dressing being about one-half inch thick. The cow manure was next applied. The golf course resembled a busy farm until spring. Regardless of frost or snow, the work went along. No seed was used. In the spring, chain harrows were brought into play, and the fairways were cleared of litter and stones. In 1925 the turf was vastly improved. Special attention was nevertheless given to the poorer areas. Turf in the rough was mown to fairway length and taken to sod steep hillsides and bad spots in the fairways, and additional soil was added where needed.

In 1926 the National Amateur Championship was played at Baltusrol. The same year a water system was carried to nine of the fairways, which helped much in improving the turf, and the system of patching with sod and top-dressing with soil was continued.

During these three years sulphate of ammonia had been used on the greens with good results, and in the fall of 1926 the first application was made to the fairways. The difficulty of applying sulphate of ammonia to large areas is well known. The writer has not yet seen a machine capable of applying such highly concentrated fertilizer evenly and lightly enough. The nearest approach to the desired machine is the one here illustrated. This machine will distribute as little as 100 pounds of sulphate of ammonia per acre, but the distribution is spotty. The difficulty can be entirely overcome, however, by applying the fertilizer mixed with cottonseed meal. At Baltusrol our best results have been obtained with 500 pounds per acre of cottonseed meal and 150 pounds of sulphate of ammonia. These two fertilizers are thoroughly mixed before being placed in the hopper of the machine. The machine is drawn by a tractor, which travels at a rate of about five miles per hour. By this method a fairway can be fertilized in about the same time as it would take to mow it with a three-

unit gang mower. If reasonable care is exercised in mixing and applying these two fertilizers no burning results. Some burning will however occur if the mixture is applied when the grass is wet with dew or rain.



Side and rear views of tractor-drawn fertilizer distributor used at Baltusrol Golf Club for applying a mixture of sulphate of ammonia and cottonseed meal.

This system of fertilizing was not carried out with sufficient care to warrant definite conclusions as to just what proportion and quantity give the best and most economical results. The greatest attention was given to the obtaining of even distribution and to the avoidance of burning. Some fairways were badly burned during the experiments, but they recovered in two weeks. The yellow stripes turned dark green in a month, and can be seen to this day. The most marked effect of this fertilizing is the remarkable increase in the finer grasses, the bents and fescue, and a decided decrease in the quantity of clover.

As to the frequency of application, this has to date been governed entirely by the needs of the turf; but the time has now arrived when a uniform system can be employed.

Tees are fertilized by top-dressing with soil and sulphate of ammonia. They are never reseeded, but are patched when necessary. On busy courses, seed has little chance on tees.

Seed is not used on the putting greens. Velvet bent sod is taken from the fairways when patching is necessary; and these occasions are rare.

On steep hillsides subject to wash, the use of sod is the only solution on our soil. This takes time, and is expensive; but the result is immediate and usually permanent.

Controlling Fairway Weeds with Sulphate of Ammonia

By Joseph Valentine

Sixteen years ago the fairways of the east course of the Merion Cricket Club, Haverford, Pennsylvania, were seeded with a mixture of Kentucky bluegrass and South German mixed bent. The following year the fairways of the west course were seeded with the same mixture. Our fairway fertilizing program then included the application of bone meal, mushroom soil, nitrate of soda, and some limestone especially where we believed the soil to be acid. In 1920, eight years ago, our fairways were covered with crab grass, goose grass, and clover. In the latter year we discontinued the use of nitrate of soda, and in its place began the use of sulphate of ammonia. The weeds in the fairways have since been reduced about 80 per cent, and the clover almost 90 per cent. In fact, there is practically no crab grass in our fairways at this time. We expect to have all the weeds and clover completely eradicated within the next few years.

This year, for the first time, we have also used activated sludge on our fairways mixed with arsenate of lead at the rate of 500 pounds of the sludge and 40 pounds of arsenate of lead per acre. The arsenate is used as a grub control and also to eliminate chickweed, which has started to appear prominently on some of our fairways. Last year we used arsenate of lead on our putting greens, applied mixed in top-dressing at the rate of 2 pounds per 1,000 square feet of surface. We did not have to remove a single plug of chickweed from the greens, as had been necessary previous years, and very little of the so-called fall grass appeared on the greens.

Briefly, our present fertilizing program for the fairways is as follows: Late in the fall, in November or December, we top-dress the fairways with mushroom soil. Early in spring, about March, we apply sulphate of ammonia at the rate of 150 pounds per acre. Late in May the activated sludge mixed with arsenate of lead is applied. The first rainy day in July or August another application of sulphate of ammonia is made, and about the middle of September still a third application. The sulphate of ammonia is broadcast by hand, often mixed in compost to give more bulk. In making the midsummer and September applications during periods of rain, the men are sent out in raincoats. The rain washes the chemical off the leaves of the grass and into the soil, and thus prevents burning of the turf. This method does not affect the play on the course since the top-dressing is applied when the course is least used. The cost of the top-dressing, including the material, screening, hauling, and spreading, is about $3.75 per ton. The sulphate of ammonia is applied at the rate of 150 pounds per acre. The analysis of the activated sludge is moisture 3.02, nitrogen 6.17 (equivalent to ammonia 7.49), and phosphoric acid 2.03. We fertilize only the areas of the fairways which are most used, such as where the drive is supposed to drop, and the approaches to the put-

ting greens; that is, we start at about 150 yards from the tee and fertilize up to about 275 yards, and then about 50 yards on the approaches to the putting green. The soil on our east course is a clay loam, and on the west course a sandy loam. We discontinued the use of lime in 1916, but have continued using mushroom soil since 1915.

Fortunately we have no real bad slopes on our course, although we did have some bad spots on some of our sloping fairways on the west course, which required fertilizing to the extent of twice as much as on the flat fairways. We however have some shaded spots, which we seeded with rough-stalked bluegrass (*Poa trivialis*). This grass makes a good turf under shade conditions, when fertilized in the same way as our other fairway turf.

With new plantings on the fairways and tees we generally use the same method of fertilizing as outlined above, except that the areas are top-dressed more frequently, and the activated sludge is applied at the rate of about 500 pounds per acre mixed with about 100 pounds of acid phosphate.

All our tees are treated the same as the fairways, except that we can water the tees, but not the fairways at the present time. We are contemplating irrigating the entire east course, when we should be able to keep our famous course in perfect condition during the summer months. We believe that with irrigation we shall not have to wait anxiously for rain in order to apply the sulphate of ammonia or other chemicals such as are used in the checking of brown-patch, in order to prevent burning of the turf. We also have reason to hope that with irrigation a great percentage of annual bluegrass (*Poa annua*), which has gradually invaded much of our fairway turf, will survive the summer months, inasmuch as where the sprinkler reached last year nearly all of this desirable grass lived through the summer.

The Fairway Problem on an Alkaline Soil

By John MacGregor

Our main fairway problem at the Chicago Golf Club, near Wheaton, Illinois, seems to be a fight for the control of weeds and clover. The black gumbo soil on which our course is built is of a high lime content, and a factor which tends further to increase the alkalinity of the soil is the lime in the water used for irrigation. Three years ago we started using a commercial fertilizer which we regarded as suitable for counteracting the alkalinity of the soil, and although we realize that it will be a slow process to accomplish this purpose under our particular conditions, covering no doubt a period of several years, we are encouraged to believe that we are working in the right direction. The analysis of the fertilizer we use is 12 per cent nitrogen, 6 per cent phosphorus, and 4 per cent potash. Until now there has hardly been any noticeable difference in the growth of weeds and clover on our fairways, except that this spring the leaves of the clover seem to be smaller than usual.

In addition to the use of fertilizer to counteract the alkalinity of the soil, we have adopted the plan of maintaining a creeping bent and fescue nursery for fairway purposes so as to supply us with turf with which to replace the clover. This nursery was started three years ago, and we found the move to be a wise one. The year after

the nursery was established the clover had increased in places in the fairways. The following spring we commenced to strip the areas where the clover had gained supremacy, replacing it with bent and fescue turf. We are continuing this feature of our program this spring. Seeding such areas in the spring we have found to be very uncertain. Tractors and mowers going over these spots disturb the young grass and usually result in patchy fairways. Our faith in the bent and fescue grasses as a means of retarding clover in fairways is based on our experience with these two grasses in certain of our fairways which were seeded with Chewings' New Zealand fescue and German mixed bent. One-third of our fairways were seeded with a mixture of redtop and fescue, and two-thirds with fescue and German mixed bent. We have found that the latter combination makes an ideal fairway, forming a dense turf in which weeds and clover do not seem so readily to gain a foothold. It is on the fairways that were seeded with redtop and fescue that we are having our main fight with weeds and clover.

The turf on our fairways is six years old. About seven years ago the course was reconstructed. At that time the fairways received a heavy application of barnyard manure, which was plowed under, and the areas were then seeded with oats and soy beans. When these had gained a height of about 1½ feet, they likewise were plowed under. The fairways were then prepared for seeding with grass. We considered that the growth of oats and soy beans which was plowed under would give us ample humus in the soil for a period of four years, high in nitrogen content. We still follow this system in new fairway plantings, growing and plowing under a green-manure crop of either red clover or soy beans. When the area is then turfed, it is top-dressed with a compost rich in humus. A green-manure crop is also grown and plowed under on the areas in our fairway turf nursery from which we cut turf for patching. These areas are plowed in June, then planted with soy beans. When the crop of soy beans has attained a height of 1½ to 2 feet, it is plowed under and permitted to lie for two or three weeks before anything is done. The ground is then thoroughly disked weekly until time for setting out the nursery, this cultivation serving to keep the soil clean of weeds and foreign grasses.

We fertilize all our fairways once a year, in the early spring before the frost is out of the ground. We have found a lime spreader an ideal machine for making the application. The fertilizer is applied at the rate of 700 pounds per acre. Special attention is however given to the approaches. About 12,000 square feet of approach area is given a compost top-dressing in the spring in addition to application of fertilizer; and every month, when top-dressing the greens, about 2,000 square feet of the approach is also included. This latter area we consider very important.

We have found applications of commercial fertilizer very beneficial to mossy and shaded areas, and for washed slopes a heavy top-dressing with compost is used. On baked clay areas we use a compost with a higher percentage of sand. The tees are treated the same as the greens, receiving a top-dressing of compost once a month; but the grass on the tees is not cut so close as on the greens.

Notwithstanding the high percentage of lime in our water, we find it necessary to keep the fairways well watered in order to have them in good condition. The weather this spring was anything but in our

favor. It was two months after the fairways were fertilized this spring before we had any rain; and in all likelihood, the acidifying effect of the fertilizer on the soil was entirely counteracted by the lime content of the water applied.

Applying Sulphate of Ammonia with a Water Cart

By T. S. Harvey, Jr.

At the polo field of the Ox Ridge Hunt Club, Darien, Conn., sulphate of ammonia is applied to the turf with a water cart, as shown in the accompanying illustration. The cart is drawn by a tractor, in lanes of 8 feet, which is the width of the sprinkling bar. The capacity of the cart is about 200 gallons. The water supply is located at one end of the field. The supply valve is regulated so that the cart is able to make the one trip up the field and one trip back. The

Applying sulphate of ammonia with a water cart.

area covered in a round trip, the field being about 900 feet long and the sprinkling bar 8 feet wide, is 14,400 square feet. The sulphate of ammonia is applied to the turf at the rate of 4 pounds per 1,000 square feet, 57.6 pounds of the sulphate accordingly being used in each barrel of water per round trip. It takes about a day to cover the entire polo field, which is about nine acres in area. The sulphate is applied four times during the year, twice in the spring (May 10 and 30), and twice in the fall (September 10 and 30).

Experiment, and keep on experimenting.—A rule of turf maintenance that is a success on one golf course may be a failure on another. The local character of the soil and local climatic conditions are generally the decisive factors that limit the use of a particular grass or of a certain cultural practice. Before inaugurating a new practice on a general scale it is always advisable first to try it out on a small scale. Every golf course should have its experimental garden.

Southern Florida Fairways

By Frank Swanson

On all the five courses of the Florida East Coast Hotel Company our special endeavor is to get the fairways all in carpet grass, which we believe is our best fairway grass. At present the fairways are generally a mixture of close-lying weed growth, Bermuda grass, St. Augustine grass, and carpet grass. We find that these last two grasses will gradually crowd out weeds and even Bermuda grass. The turf on some of our fairways is 10 years old; on others the planting was as recent as three years ago. For the past five years or more our program has been to make two applications of fertilizer a year, and only on the approaches and areas receiving most wear. We use a 5-8-2 commercial fertilizer, applying it spring and fall with a mechanical distributor, at the rate of 300 to 500 pounds per acre. Of course, since we maintain winter play only, this treatment does not interfere with play. On the tees we follow the same program, except that we make the application twice as heavy. Considering cost of material, hauling, ease of distribution, as well as results obtained, we favor the use of commercial fertilizer. With new plantings, in order to hasten the development of the turf, we have found it advisable to apply sulphate of ammonia to the soil at the time of planting and to keep the areas watered; but with established fairway turf our program does not include the use of either ammonium sulphate or watering.

Organic Fertilizers on Fairways

By Erich W. Pahl

Four years ago our fairways at the Interlachen Country Club, near Minneapolis, were fertilized completely with a mixture of muck (heavy peat soil) and manure in the proportion of one part of manure to three parts of muck. Since then the fairways have all been piped for watering, and they held up in good shape until last fall, when we again applied the same mixture to the weaker spots, which already are showing the benefit. The application was made with a manure spreader, which will throw an even spread, and was applied reasonably heavy. This spring we dragged it in with a matting. We used this material because we had enough available, but as our supply is now exhausted we are planning on a yearly fertilization program, taking six or nine fairways each year. We expect to use activated sludge for this purpose, and may try in comparison some of the other commercial fertilizers. On washed slopes we make a heavier application, and keep it watered thoroughly. Our tees are fertilized the same as the greens.

We water our fairways every other night, and if necessary, on high spots, we leave the sprinkler on all day; but we find that with regular watering we seldom need any all-day watering. Our turf is now about 16 years old, and is on a heavy clay soil with very little loam on top. The predominating grass on the fairways is bluegrass, with plenty of bent of all varieties covering large spots on practically all the fairways. This bent has come from seed in the original seeding of bluegrass and redtop, and since we have been watering the fairways it has spread very rapidly.

Maintaining and Fertilizing Bermuda Grass Fairways

By Howard Beckett

The dominant grass in our fairways at the Capital City Country Club at Atlanta is, naturally, Bermuda grass, although during the winter and spring months we have a fine growth of rye-grass and Japanese clover. Seven or eight years ago these fairways were just about as poor as most fairways are here in the South, but today they are better than any others I have seen in this section, and this condition I attribute to the fertilizer we have applied and to the fairway tractor which we have used for the past five summers. Our soil is a very poor clay, which has a tendency to dry out rapidly after a rain and get very hard, and for this reason we use a tractor mower with large wheels studded with 1½-inch spikes. By going over the fairways twice a week with this tractor mower, the turf is kept in good condition, the Bermuda grass being thus given a better opportunity to spread and the fertilizer being permitted to go down to the roots of the grass.

We fertilize all our fairways every fall with raw bone meal, applying about one ton of meal per acre, and using a regular two-wheel spreader drawn by a pair of mules. In the spring the extremely bad spots in the fairways are sprigged with Bermuda grass and covered heavily with barnyard manure. In fact, all bare spots where the Bermuda looks poor are covered with manure.

Since using bone meal we have noticed a great deal more white clover in the fairways. We use this same method in planting our tees, but for fertilizer on the tees we use tankage, applied during the growing season, as it seems to be quicker in action than is bone meal.

Briefly, best results seem to be achieved by plenty of cutting during the growing season, and in the fall and spring the abundant use of organic fertilizer.

A compost pile at each putting green, under cover of a shed, screened from view by trees and shrubbery, would be ideal for the sake of convenience. But this is not possible on many golf courses, due to lack of proper screening. The ideal may be approximated to a certain extent, nevertheless, by locating compost piles, preferably under shed cover, wherever possible on the course conveniently situated with reference to one or a group of greens.

No free acid in superphosphate.—In connection with the change of the trade name of "acid phosphate" to the original term "superphosphate," which has been approved by the Association of Official Agricultural Chemists and by the National Fertilizer Association, the attention of this department has been called to statements occurring in department publications of 20 or more years ago to the effect that acid phosphate was a cause of acidity in certain eastern soils. Dr. Henry G. Knight, chief of the Bureau of Chemistry and Soils, says that research has shown that the properly manufactured superphosphate (acid phosphate) of recent years contains no free acid, and that the evidence brought out by fertilizer experiments made by the department and by several state experiment stations shows that superphosphate (acid phosphate) is not a cause of acidity in soils and in most cases does not change the reaction of the soil appreciably one way or the other.—*The Official Record, United States Department of Agriculture, March* 21, 1928, *Vol.* 7, *No.* 12, *p.* 1.

AS WE FIND THEM

After playing golf in Dreamland we stopped in to attend the convention of the Amalgamated Order of Golf Course Grasses.

The controlling faction at the convention was Kentucky bluegrass, with delegates representing most states from rough, fairways, greens, bunkers, sand traps, sidewalks—almost everywhere.

The "farm bloc" of Rhode Island bent pointed out that their group played a big part in the country's basic industry of farming (in pastures) and that their importance should be more fully recognized on the fairways where "big business" tramped.

The "progressives," headed by *Poa annua*, kept breaking in on every group, and many times threatened to disrupt every effort at uniformity of action.

There was a "dry" faction from the Far West that wanted to put through a regulation prohibiting artificial watering, for they maintained grass could thrive simply on the "liquid nature provided."

The "wet" element of the East, especially the creeping bent class, all insisted that in dry weather golfers owed them a drink—at least once a day—and they would continue to insist upon it.

As is customary at all such gatherings, there was much grumbling about the weather, but no action was taken to improve it.

Red fescue insisted on having a ruling prohibiting hot summer weather, whereas Bermuda grass and some of its followers insisted that hot weather be demanded at all times.

After much such wrangling, the discussion turned to greenkeepers, green committees, and golfers in general. That topic brought harmony to the convention. The delegates were unanimous in deciding that:

"Man is a queer, stupid beast. He never can agree on any one treatment for all classes in his own big family, but when he deals with anything else, especially a big assortment of grasses, he expects them all to want the same thing and all to respond in the same cheerful manner to the same treatment."