

moisture in the upper layers of soil, or upon the surface, moves as nearly directly downward as the soil formation will allow, until it reaches the level of the groundwater. It then moves downward and laterally in a curved path to the drain, entering it from the bottom. Its movement after reaching the groundwater level is somewhat uncertain.

In speaking of the relative efficiencies of different systems, it is often stated that the underdrains in one field "draw" better or farther than those in another field. Actually the drains do not draw at all, if by that it is meant the tile exert a pull tending to suck the water out of the soil pores and into the drain. The underdrains serve simply as collecting channels or outlets for the percolating water. If one area is drained farther back from the lines of the tile than is another, it signifies simply that the conditions of the soil are such as to cause a more ready movement of the groundwater to the tile in the one area than in the other and that the tile in the better drained area have ample capacity to remove the water as it reaches them.

Fall or Gradient: The smaller the tile the larger should be its fall or gradient. A fall of 1 inch in 100 feet may be sufficient for an 8 inch tile; but for a 4 inch tile, 3 inches in a 100 feet is about the minimum limit.

(To be continued)

NEXT MONTH—How to determine sizes of tile in line with rate of run-off.

How To Keep Skunks Off the Greens

By JOHN McNAMARA

WHILE in Detroit at the Fort Shelby Hotel, a Chairman of a Green Committee of a nine hole course in Michigan reported that they had quite a bit of trouble with skunks rooting up their greens. He thought they were after the angle worms in the greens.

In taking this matter up at one of our meetings, there were many different censors of opinion as how to get rid of these pests. Some suggested that a hose be attached to the exhaust of a tractor and the end put to the hole or burrow of the skunk thereby killing them by suffocation, others thought that shooting them on bright clear nights would be a good way to get rid of them.

In my opinion, with the little experience I have had with them, I do not think they are after angle worms but a white grub that is in the ground, and the best way to get rid of the skunks so that they do not root up the ground, is to remove the cause by getting rid of these grubs. This can be accomplished by using Arsenate of Lead in very light applications of one or two pounds to every 1000 square feet—mixed with soil or sand and spread evenly over the green when the grass is dry, in the same manner as you sow seed, etc. Continue this application about every two weeks and as soon as all the grubs have disappeared you will also find that the skunks will no longer molest the greens. You will also find that if robins root your greens in a like manner, that this method will be effective in keeping them off your greens.

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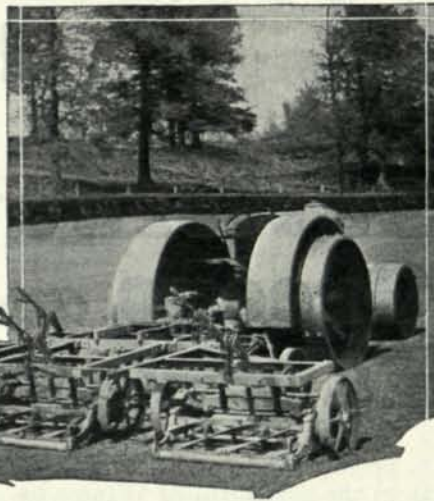
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The Control of Ants

Facts about the dominant family of insects that at times infest golf courses. How to get rid of them without injury to the turf

By M. A. DANIELS, Greenkeeper

Pontiac Municipal Golf Course, Pontiac, Michigan

Read before the second annual convention of the National Association of Greenkeepers of America at Detroit

THE present time has been termed the "Age of Insects," and of all insects the Formicidae, or Ants, are the dominant family. Not only do they outnumber in individuals all other terrestrial animals, but their colonies often defy enumeration.

Ants, technically classified, belong to the Hymenoptera Order of Insects along with Bees and Wasps. Ants, themselves, form the family of Formicidae. We find wonderful development of instinctive powers in this order and an outstanding character of social development.

The great number of ants and their wide distribution render them one of the most familiar of all insects. They may be found from the Arctic regions to the tropics, from the timberline to the sand dunes and seashore, and from the dampest forests to the driest deserts. A technical description, I believe, is hardly necessary. However, it will be well to devote a few minutes to discussion of some of their outstanding characteristics and qualities.

Ants Are Social Insects

ANTS are social insects. There are no solitary species. Each colony consists of three castes, the males, the female or Queen, and the workers. As with the social bees and social wasps, the workers are all modified females. In most species the males and females are winged but the workers are wingless; the wings of the female, however, are deciduous. The presence of these castes is not always uniform varying both in form and duties they perform.

In primitive species, there is not much indication of caste development and colonies are made up of only a few dozen numbers; but in the more highly specialized forms a colony may consist of hundreds of thousands of members and exhibit an elaborate polymorphism. The different species of ants also differ in their nesting habits. However, in the profession of greenkeeping, we are principally interested in those colonies which build large mounds in the ground.

Nests Do Not Contain Cells

THERE is a striking difference between the nests of ants and those of wasps and bees in that the nests of ants do not contain permanent cells for their brood. The eggs, larvae and pupae are stored in chambers of the nest and are moved from one to the other to take advantage of changes in moisture and temperature conditions. It will suffice to state that during the mating

season among most species there are provisions which prevent too close interbreeding.

Large swarms of winged ants usually indicate the nuptial period. After mating, the males usually soon die and the female proceeds to form a new colony, if she is not captured by workers of a colony already established, or finds her way into one. This indicates the migratory habits of the ant.

How An Ant Colony Is Founded

THE method of founding a colony follows: the female breaks off her wings and seeks or makes a small cavity in the ground. She closes the entrance and remains for weeks, without food while the eggs in her ovaries are developing. During this period there is a histolysis of the large wing muscles the products of which are assimilated as food. When the eggs are mature they are laid and the larvae that hatch from them are fed and cared for by the Queen ant till they are ready to pupate.

The adults that develop from the first brood are workers, but due to the limited amount of food that they have received, they are abnormally small, the form known as worker minors. They open the chamber and venture forth to collect food for themselves and their Queen and care for the second brood which are known as the worker majors, due to the fact that they have had a more abundant food supply. Thus the colony continues to grow and a few years later numerous males and females are developed, which at the proper time leave the nest for their nuptial flight.

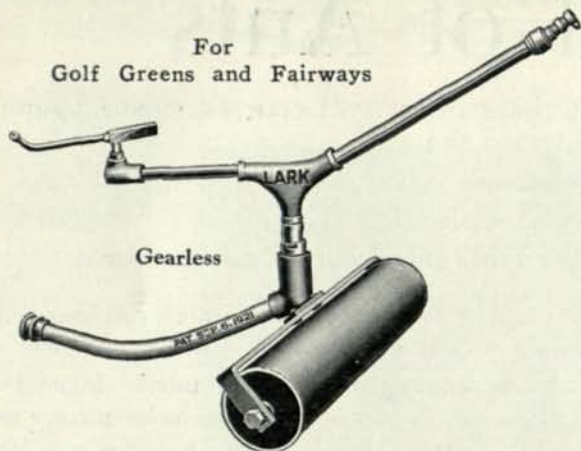
Feeding Habits Differ Greatly

THE feeding habits of ants differ greatly in different members of the family. Some of the primitive forms are strictly carnivorous while others add vegetable substances to their diet. Many feed on the sweet fluids, as sap exuded from plant stems, the nectar excreted by extrafloral nectar glands and honey dew produced by aphids and other insects. Still others termed leaf-cutting ants cultivate fungi upon which they feed. I believe that there is here an opportunity for considerable research work.

From the discussion so far, the proposition of developing a satisfactory control presents itself as a huge problem. To determine a control for any insect it is imperative to first know its life history or metamorphosis. Such a study exhibits the most economical point

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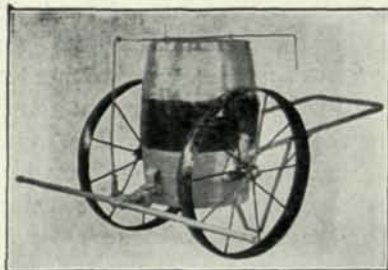
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of attack for control measures. In the case of ants, the most plausible stage is the adult period.

Only Two Possible Methods of Control

THERE are only two possible methods of control in this adult period. They are contact and internal controls. Carbondisulphide, lime, pepper and cyanide compounds are examples of the contact methods now in use for exterminating ants. Due to the highly developed instinct of ants, these control measures suffice only in forcing them to move to some new location.

When trapped, cyanide may exterminate some of them, but a 100% kill is difficult and usually the effectiveness of the exterminator is directly proportional to damage or injury to turf or soil. Paris-green, arsenate of lead and copper sulphate are examples of poisons used in internal poisoning given them as an ingredient in their food. However, there is a hazard in the use of these materials. Using them strong enough to be effective often results again to injury or damage to the turf or soil.

An Internal Control Exterminator

THE exterminator which I introduced in the Detroit District late last summer is of the internal control type. The preparation is in a heavy paste form and contains organic materials. There is absolutely no danger of injury to turf, or soil chemical reaction. Small portions or balls from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch in diameter are placed near the ant hill or mound on the green.

Nature then comes to our assistance and heat from the sun produces a liquid film on the outside of the ball. Within a few minutes the ants literally cover the sample and feed ravenously. It is desired to produce this liquid film as the ants feed mostly by sucking. They do have biting mouth parts but they are not developed for chewing. For some time after feeding they show no effects.

Extermination Complete in 36 Hours

THERE is a purpose, though, for this condition. As I have related before, ants are characteristically highly socialized and made up of castes. It is essential that the workers return to the nest and feed those whose duties keep them within the nest. It takes from twenty-four to thirty-six hours before activity ceases and extermination is complete. Due to lack of care, which I have previously emphasized, the eggs, larvae and pupae cease in their development.

However, due to their migratory habits it is impossible to keep a green once treated free from future infestations. It is a good policy, therefore, to keep the area near the green free from infestations and this will greatly tend to keep out future invasions. One pound of this exterminator will practically clear up the heaviest invasion of an ordinary green and often is sufficient for several greens on the course.

Further information or a trial sample may be had by addressing your correspondence to M. A. Daniels, greenkeeper, Pontiac Municipal Golf Club, Pontiac, Michigan.

GREENKEEPER'S ALMANAC

MAY

By JOHN MACGREGOR
Chicago Golf Club

Greens planted with bent stolons now, will mature rapidly, as weather conditions are favorable.

Do not allow the grass to get long before cutting, keep it down.

Top-dress at least every two weeks until the turf is established.

Brush and cut every day and you will be rewarded with a putting green.

Established greens should be brushed and cut every day to prevent running or napping, either stolon or seeded greens.

The greens should be freed from weeds now. Experiment with Ammonium Sulphate and Arsenate of Lead for weeds and worms. Arsenate of Lead may be the solution to the worm problem; if so, the greenkeeper will be able to stand a little more erect.

Another light top-dressing on the greens; and don't stop at the green. Top-dress the approach twenty feet in front of the green. This is just as important as the green for many a beautiful shot has been spoiled in this particular area.

It is not too late to feed the fairways. If more nourishment were given the grass there would be less money wasted on grass seed. Regular mowing, of course, is necessary.

Returfing can still be done, if rains are not frequent. New turfing should be watered.

Sand traps and bunkers demand attention.

Keep the rough cut, as the grass grows rapidly now. The sickle mower attachment on the Fordson is truly a money saver.

Have everything in tip top shape for Decoration Day.

Last but not least. Are you a member of the National Greenkeepers Association? If not, send in your application now. Have you paid your dues for 1928?

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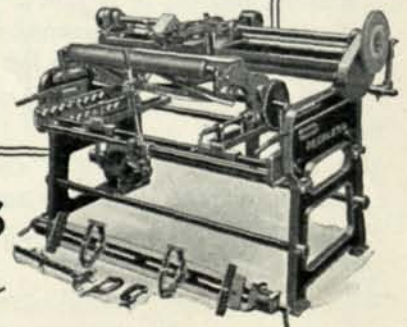
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Arsenate of Lead

By JOHN BABBAGE

THE invasion of the Japanese beetle in the Eastern sections of this country threatened the destruction of turf grasses on golf courses. The problem became so serious that the Green Section realized the importance of devising effectual control measures. Investigations were made by Mr. B. R. Leach of Riverton, New Jersey, and as a result of his research effective measures are now available for combating the grub of both the Japanese and June beetle.

The results of his work showed that the application of dry powdered arsenate of lead to golf courses gave good control of these pests and also retarded and stopped the growth of certain weeds.

Grubs in the soil are a serious menace to turf. They feed on and destroy the root system of the grass. The turf soon dies leaving the unsightly bare areas.

In some instances the ravages of the grubs are so complete that the turf loses contact with the soil and can be lifted or rolled with little effort. Until efforts are made to control the grubs it is a waste of time and money to attempt any turf improvement by reseeding or the application of fertilizers.

When arsenate of lead is used for controlling grubs in golf courses, the process is usually referred to as "grub-proofing" the golf course. There are several different methods of grub-proofing a golf course.

Grub Control

NEW tees and greens are "grub-proofed" in the process of construction but before seed or stolons are sown by applying five pounds of arsenate of lead to each 1,000 square feet of soil surface and raking it in with a short-toothed rake to the depth of one-half inch. Apply arsenate of lead after all grading, smoothing and contouring has been completed.

In established greens and tees where a serious infestation of "grubs" is present, thoroughly mix 25 pounds of arsenate of lead with a cubic yard of top-dressing material and apply it uniformly to 5,000 square feet of turf. Use a broom or rake to work in. Apply when the grass is dry to permit working down through the grass without sticking.

Another method is to mix 5 pounds of arsenate of lead with a bushel of screened moist sand or soil and scatter this over 1,000 square feet of turf. If the second method is used, apply the arsenate of lead only when the grass is dry.

In cases where no "grubs" are present in the greens or tees but damage by them is anticipated, mix 5 pounds of arsenate of lead with a cubic yard of top-dressing and apply it to 3,000 square feet of turf. Repeat with the next four top-dressings.

Once a green or tee has been "grub-proofed," the top-dressing with unpoisoned soil should not be practiced, otherwise, the layer of poisoned soil will be buried and the turf will no longer be "grub-proofed."

As top-dressing is applied to the surface of a "grub-proofed" green or tee, arsenate of lead should be applied in proportion. Use one-half pound of arsenate of lead to each 1,000 square feet of turf, assuming that the top-dressing is applied at the rate of one cubic yard to 5,000 square feet of turf.

How to Apply to Fairways

FAIRWAYS that are infested with grubs should also be "grub-proofed." Arsenate of lead applied at the rate of 250 to 300 pounds to the acre controls "grubs" and worms in fairways and controls certain weeds. Mix it with fine soil or sand and apply with a fertilizer spreader. This initial application should last for at least two years on fairways where no soil washing occurs.

This treatment should insure "grub-proof" fairways for at least two years and thereafter an application of 100 pounds of arsenate of lead per acre applied annually should keep the fairways in "grub-proofed" condition.

Arsenate of lead should be applied to the turf preferably before June 1 if an infestation of "grubs" is anticipated. Where "grubs" are present in the turf, apply arsenate of lead at once regardless of the time of the year provided the ground is not frozen or muddy.

Arsenate of lead when applied to greens and fairways not only controls grubs but also seems to eliminate such weeds as chickweed and crab grass. Although arsenate of lead is a deadly poison there is no evidence of toxic soil condition developing as a result of its use even from repeated applications.

Because arsenate of lead is such a deadly poison it is also used to control many of the pests that infest the trees and shrubs around the club house and on the course. Chewing insects such as worms and caterpillars can be controlled by spraying the foliage with arsenate of lead.

The dilutions to be used varies with the kind of insect to be controlled on the plant being sprayed. This is because it takes a stronger dosage of arsenate of lead to kill some insects than others.

Usually three pounds of arsenate of lead to 50-gallons of water will control most chewing insects. Arsenate of lead is more important to the greenkeeper than his fertilizers because what use is it to have a fertile productive soil that will grow fine turf and beautiful bushes unless we control the pests which ravage them?

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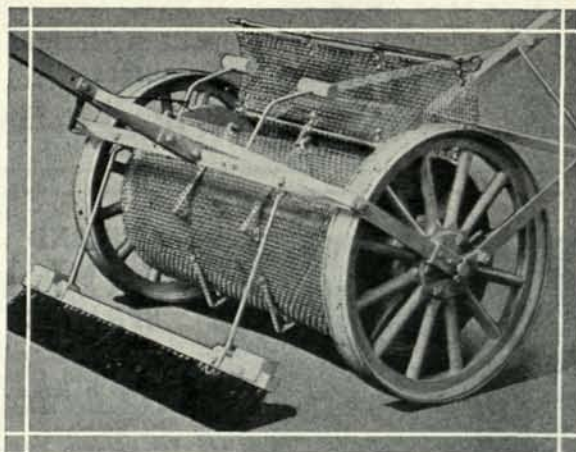
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If I hear of any club requiring a good topdressing machine, I certainly will recommend the MacGregor Compost Distributor. Wishing you continued success, I remain,

Yours very truly, Robert Duguid, Greenkeeper.

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Stony Brooke Golf and Country Club, Stony Brooke, Long Island



Wm. G. Gilbert

ARRIVING at Stony Brooke three seasons ago I was confronted by labor troubles and construction work,—not a good combination. The course is located at Stony Brooke, Long Island, New York.

The first thing to do was to settle the labor question which was done by weeding out the trouble makers. That settled, construction work was started. Seven greens were re-modeled, six tees were made, numerous new traps were made and others

changed, and two fairways were widened which meant clearing of five acres of woodland.

There are about one hundred and fifty traps on the course.

Two bridges and a shelter were built by our own men. Lumber for the walk and rails was the only material bought, and the uprights are set in concrete.

Very Little Area of Rough

The upkeep of the course is run about the same as many others. The fairways are blended into one another so that we have no rough to speak of but it means extra work for the fairway machines which consist of a gang of five Toros and another gang of Roseman mowers.

The course being of a sandy nature makes watering an important factor, which is done from five P.M. for

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And this is why they sow it. In the words of a Pennsylvania Greens Chairman: "We seeded our 9 hole course with Scott's Seed and many golf enthusiasts pronounce it the best year-old turf they have ever seen. Our 9 greens were sowed with your German Bent and today there is surprisingly thick green turf. Now you know what I think of Scott's Seed." For the good of your course get more facts about Scott's Seed before you buy.

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as long as necessary, using double rotary sprinklers.

A few words about our nursery, which was planted in the early fall and came up strong in the spring. I cut as early as possible, sweeping the cuttings into the space between the rows. I then top dressed and rolled the cuttings lightly, not forgetting lots of water. By the latter part of June we had a solid mat of turf. Top dressing, close cutting and plenty of water help a great deal. We hope to start four or five more plots this fall.

Where the Big Tournaments Will be Held

May 7-12—British Open Championship, **Royal St. George's Club**, Sandwich, Kent.

May 14-19—British Ladies' Championship, **Hunstanton**.

May 21-26—British Amateur Championship, **Prestwick**, Ayrshire.

June 11—Qualifying Rounds in National Open Championship, various districts.

June 13-16—Metropolitan Amateur Championship, **Fenimore C. C.**, White Plains, N. Y.

June 21-23—National Open Championship, **Olympia Fields C. C.**, Chicago.

June 25-30—Ohio Golf Association, Amateur State Championship, **Youngstown Country Club**, Youngstown, O.

June 27-30—Western Golf Association Open Championship, **North Shore Golf Club**, Chicago.

July 18-20—Metropolitan Open Championship, **Shackamaxon C. C.**, Westfield, N. J.

July 6-7—New York State Golf Association Open Championship, **Onondaga Golf and Country Club**, Syracuse, N. Y.

July 31-Aug. 5—Public Links Championship, **Cobbs Creek Course**, Philadelphia.

August 15-18—Buffalo District Amateur Championship, **Cherry Hills Country Club**, Buffalo.

August 27-Sept. 1—Western Golf Association Amateur Championship, **Bob O'Link Golf Club**, Chicago.

August 30-31—Walker Cup Matches, **Chicago Golf Club**, Wheaton, Ill.

September 10-15—National Amateur Championship, **Brae Burn C. C.**, West Newton, Mass.

September 24-29—Women's National Championship, **Virginia Hot Springs Golf and C. C.**, Virginia Hot Springs, Va.

October 5-6—Lesley Cup Matches, **Winged Foot Golf Club**, Mamaroneck, N. Y.

Around the Office Desk

Buffalo Greenkeepers Organize

HAVING read and enjoyed the April issue of the NATIONAL GREENKEEPER it occurred to me the following would be of interest to you.

The greenkeepers of this vicinity have brought into being and successfully launched the Western New York District Greenkeepers Association to promote the welfare and increase the efficiency of themselves and the clubs they serve in the capacity of greenkeepers.

During the discussion held at our first meeting the subject of grasses and turf best adapted to withstand the rigors of our climate and soil, as we in western New York have to contend with was of benefit to all of us. Many of those in attendance at the meeting felt that they were amply rewarded for their payment of the first year dues, as the exchange of experience and opinions will be made a part of each of our monthly meetings. The year round meetings will certainly prove of great educational value to the greenkeepers and will in turn react to the benefit of the clubs employing us in the perfecting of their courses.

In addition to the business of talking shop we took sufficient time to start our local with a full set of officers, as follows, Robert Henderson of the Buffalo Country Club, president, W. T. Rothman, Niagara Falls Country Club, vice-president, Art Stevens, Grover Cleveland Park, treasurer, and Al Schardt, Wanakah Country Club as financial secretary. A Board of Directors consisting of Custer Stallman, Grant Eastman Park, Country Club of Rochester, Frank Bulges, Municipal Links, Niagara Falls, A. W. Kroll, Country Club of East Aurora completed our roster.

Our first meeting was held on March 23, 1928 at Grover Cleveland Park Club, Buffalo, N. Y. and we are indebted to the officials of this club for their interest shown in our behalf and the assistance rendered by them in offering to us the use of their clubhouse as a meeting place to launch our campaign for an organization that is intended to include every eligible greenkeeper within this territory, i. e., from Erie on the West to Rochester on the East and along the shores of Lake Erie and Ontario and as far south as Hamilton—this region includes nearly every club of importance contiguous to the larger cities of western New York and Ontario, Canada.

With a territory of this size and the number of clubs within it our local will ultimately reach a considerable membership, and as our aim is to have every greenkeeper within this district an enrolled member, if not before the national convention to be held in Buffalo this year, at least before our local is a year old. It is the opinion of the writer that the clubs can and should give all assistance possible to organizations of the character of ours by urging their greenkeepers to become affiliated, inasmuch as our principal objective is to exchange ideas and discuss maintenance of golf courses and their constant improvement.

You can feel assured of our most hearty co-operation. We are just starting, but upon convening of the national

convention in Buffalo this year we hope that those in attendance will be greeted by as well organized and enthusiastic a group of greenkeepers as is known in the national association.

Al Schardt, Secretary, W. N. Y. D. G. A.
P. O. Box 44, Buffalo, N. Y.

* * *

An Appreciated Honor

Mr. R. E. Power, President,
The National Greenkeeper,
Caxton Building,
Cleveland, Ohio.

At our last meeting of the Cleveland Group of Greenkeepers you were made an honorary member of the association.

Enclosed you will find your membership card and hope that you will attend meetings as regularly as convenient.

Frank Ermer, Secretary.

R O Y E R

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What a Royer User Says:

Ridgewood Golf Links,
Brooklyn Station, Cleveland.

Mr. L. F. Mitten:

In answer to your letter of December 7th, asking what I think of the Royer, well, it won't take very long to tell you that.

I think it is a real money saver, and I think I saved more than the original cost of the machine in one season on labor. As in the course of four weeks, with four men, I shredded approximately 1600 loads or approximately 3000 yards of soil, as I had to have it for topdressing for the entire 18 fairways.

Signed: Frank Ermer, Greenkeeper.

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R O Y E R