1999
RUTGERS
Turfgrass Proceedings

THE NEW JERSEY TURFGRASS ASSOCIATION

In Cooperation With

RUTGERS COOPERATIVE EXTENSION
NEW JERSEY AGRICULTURAL EXPERIMENT STATION
RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY
NEW BRUNSWICK

1999 RUTGERS TURFGRASS PROCEEDINGS

of the

New Jersey Turfgrass Expo
December 7-9, 1999
Trump Taj Mahal
Atlantic City, New Jersey

Volume 31
Published July, 2000

The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, Cook College, Rutgers University in cooperation with the New Jersey Turfgrass Association. The purpose of this document is to provide a forum for the dissemination of information and the exchange of ideas and knowledge. The proceedings provide turfgrass managers, research scientists, extension specialists, and industry personnel with opportunities to communicate with co-workers. Through this forum, these professionals also reach a more general audience, which includes the public. Articles appearing in these proceedings are divided into two sections.

The first section includes lecture notes of papers presented at the 1999 New Jersey Turfgrass Expo. Publication of the New Jersey Turfgrass Expo Notes provides a readily available source of information covering a wide range of topics. The Expo Notes include technical and popular presentations of importance to the turfgrass industry.

The second section includes research papers containing original research findings and reviews covering selected subjects in turfgrass science. The primary objective of this section is to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

Special thanks are given to those who have submitted papers for this proceedings, to the New Jersey Turfgrass Association for financial assistance, and to those individuals who have provided support to the Rutgers Turf Research Program at Cook College - Rutgers, The State University of New Jersey.

Dr. Ann B. Gould, Editor
Dr. Bruce B. Clarke, Coordinator

DO WE REALLY HAVE TO MURDER THE GRASS EVERY DAY?

Stephen Bernhard[1]

Golf courses today are under such close scrutiny that greenskeepers are forced to use almost any "fix' to achieve the ultimate appearance. This might include choice of mower, chemicals, procedures such as top dressing, and so on. What drives us? Is it the desire for approval by our members? Do we search for that ultimate playing surface? Are we looking to improve job security? Lots of issues here!

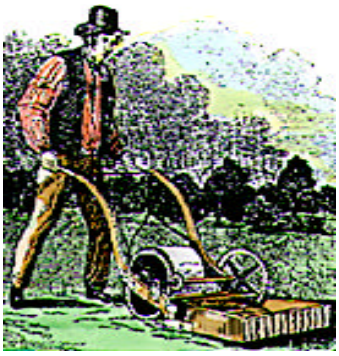
One crucial observation - the last thing one does prior to allowing the customer on the hallowed turf - is to attempt to murder it! How? By mowing it.

Grass doesn't like being damaged regularly. It's painful and potentially harmful. Nevertheless, we demand exquisite grass so it has to be mown regularly. Perhaps then, a clean healthy cut is the most important thing we can do daily.

Despite a lot of hype about the latest sophisticated mowing equipment, the basic requirements are the same as they were when carpets needed mowing with a fine, clean cut - and importantly, with consistency. Even the fanciest mowing machine will be brought to its knees by unsatisfactory cutting performance.

A little history...

Cylinder mowers were first developed by Edwin Budding for shearing the nap of carpets around 1830. Early trials failed, but later he used a helix, twisting blades into a spiral, to create his original cylinder. The bottom blade was added to hold the carpet fibers in place, positioning them, giving uniformity of cut. The helical blades caused the cutting point to be drawn horizontally across the bottom blade rather like several small scythes, each acting as a horizontally moving cutting blade.

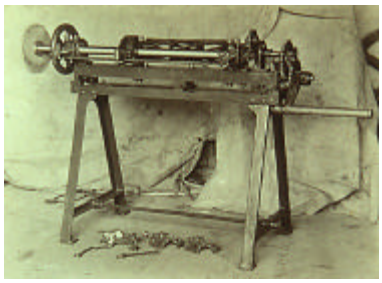


Budding applied his textile shearing concept to mowing grass, patenting his first cylinder mower in 1830, replacing the manual scythe to mow grass.

Johnny Atterton modified his griss mill grinders to help create a true cylinder for these early mowing machines. Responding to the growing demand, he began to build grinders for making mower cylinders and supplied Ransomes, Shanks, and Lloyds, the three major mower manufacturers of the day.

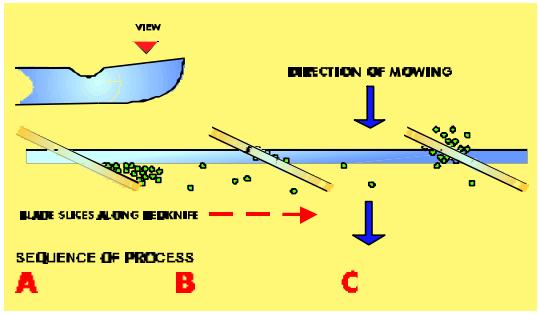
[1] President, Bernhard & Company, Ltd., Rugby, England.

Atterton also developed and patented the first commercial mower grinder. As small repair shops proliferated, he developed a range and by 1870, Atterton and Ellis, Ltd. (which is owned by Bernhard & Co. today) had four steam or hand driven spin grinders on the market. "In situ" spin grinding came about the turn of the century to eliminate the need to remove bottom blades or adjust the mower during resharpening.



The cylinder mowing process...

Despite the fact that manufacturers have continued to improve designs, much of the original cylinder geometry pioneered by Budding and Atterton remains valid today.

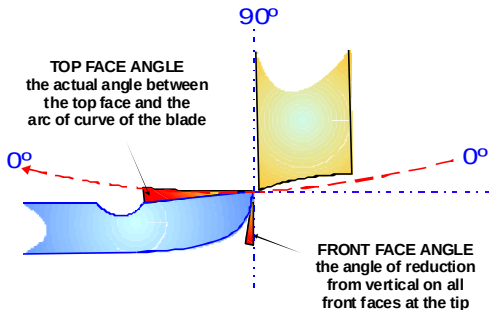


The function of cylinder mowers is simple. The helix of a cylinder is designed to produce the effect of a succession of razor blades passing along the bottom blade without contact, creating the horizontal scything action so critical to a clean cut of the leaf tissue. As it rotates, the cylinder blade draws the grass blades against the front face of the bottom blade, which positions them for a uniform cut. This also controls the height of cut. The cut material is compressed momentarily, then rapidly decompresses and is ejected from the cylinder/bottom blade interface. Top face angles of bottom blades are crucial to this function. Contact between the two blades is essentially bad as it eliminates the scything function of the operation. Despite operating with contact, cutting will continue but with poorer results.

Many greenskeepers perceive the problem of "rifling" after noticing streaking on the surface of the turf. This usually points to excessive tightening of cylinder to bottom blade. Inevitably, this causes the leaf tissue to be cut in a mechanical scissors-like fashion, often in the middle of the cylinder blade surface, rather than at the cutting edge of the cylinder and bottom blade. Instead of the clean cut achieved by scything, the leaf tissue becomes pinched. It is then literally pulled apart and ruptured during the scissoring process, rendering the grass blade vulnerable to many potential problems.

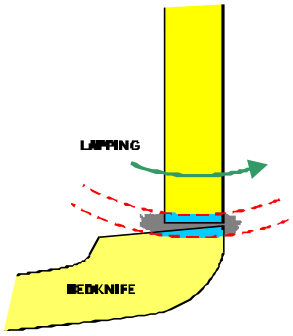
Scissors vs. scythe

In the original design, there was no contact between cylinder and bottom blade. This difference between a scissors-cut and a scything action is important to understand. Scissors require two blades moving toward one another in opposing directions. Scissors cut adequately if there is sufficient light contact. Scythes consist of a single cutting blade being drawn obliquely



across the leaf tissue, damaging fewer cells in the process. Scissors will, of course, cut, but a scythe cuts soft tissue much better. This is precisely why a surgeon uses a single-blade scalpel (which is drawn through the flesh) instead of scissors. He looks for a surgical clean cut that will heal quickly.

So what does lapping do?

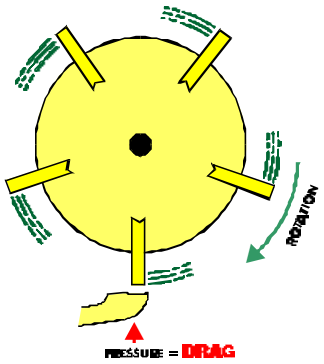


Single-blade grinding was initiated in the United States with a machine they called a "hook grinder" around 1935. The concept of lapping was developed because of the need to make crudely ground cylinders truly cylindrical. This was the same problem Budding ran into one hundred years earlier, solved then by the use of the Atterton cylindrical grinder.

Despite manufacturer's recommendations, the most precise angles and adjustments tend to be lost once the cylinder and bottom blade start to wear. This is where all the contention about relief vs. no relief, lapping vs. no lapping, and contact vs. no contact adjustment come into play.

Inaccurate grinding or lapping or wear results in varying heights of each cylinder blade. Lapping was originally invented to make the cylinder mesh evenly with the bottom blade so it would not bind up on a high blade. During the lapping process, abrasives wear down the high blades to the level of the low ones, creating a moderately sharp edge temporarily. The process also creates two curved, mirrored surfaces from the bottom blade and cylinder tip. Unfortunately, these two mirrored surfaces act like a drum brake, the cylinder forming the drum and the bottom blade acting as the brake shoe. This causes considerable wear to both and also demands more power to rotate the cylinder.

By effectively wearing away the sharp leading edges of the cylinder blade and bottom blade, lapping also turns a scythe into a scissors cut (requiring permanent light-to-moderate contact between the two surfaces). Lapping is essentially "any wearing process," even that of cylinder and bottom blade during normal use of the mower. Normal wear and tear produces curved, mirrored surfaces just as deliberate "paste" lapping does, but the surfaces are rounded and irregular - thus requiring greater and greater contact via tighter adjustment to maintain functionality.



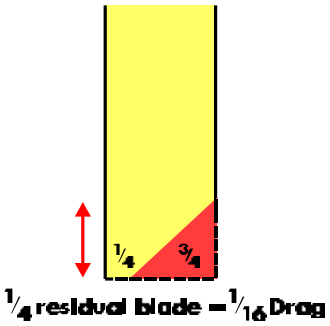
Lapping can restore some of the cutting ability of worn cylinder tips and bottom blade edges. A well-lapped blade certainly produces a far better finish than a rounded and dull blade, but is a temporary fix until the cylinder can be properly ground and adjusted again.

Grinder technology exists today, allowing a complete regrind of a greens-mower cylinder in less than ten minutes, floor-to-floor, without even dismantling any component nor adjusting any roller or bottom blade, which leads us to the hot topic of "why do we continue to use lapping as a maintenance technique"?

The Need for relief grinding

To minimize braking effect of lapped surfaces, relief grinding (also called "backing off" or "blade thinning") was invented in the United States during the mid 1930s.

Reducing the blade thickness by 3/4 reduces the torque required to turn the cylinder by a factor of 16. But it also increases the vertical (upward) thrust on the cylinder bearings by a factor of 16. Cylinder bearings are not normally designed to absorb vertical loading, causing bearings to oval over time and resulting in a fine vibration. This tends to round off the cylinder and bottom blade tips. More lapping is then required, which in turn causes more vertical thrust, wear, and vibration. And so the vicious circle continues. The need to lap becomes greater as the season advances.



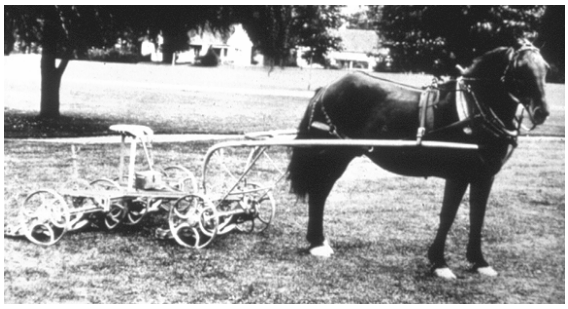
When this relief wears off from lapping and/or excessive blade contact, the cylinder blade tip becomes "fat" once again. It really should then be re-thinned to original angles and dimensions. Very few mowers still have functional relief six months into the season so the drag is massive.

Many people believe that relief grinding produces a better cut. Actually, relief grinding has no effect whatsoever on the quality of cut, since on lapped cylinders there is no relief at the actual point where the grass is cut.

Relief simply reduces the torque required to turn a cylinder that has contact with its bottom blade, so the subsequent load on the engine and hydraulics of the mower is also reduced. The best relief possible is obtained from a properly ground, non-lapped cylinder adjusted for "no contact at all." Remember, relief is the result of doing something to reduce pain, like taking "aspirin" for a headache. In the same way, blade thinning (relief) is what one does to provide relief to overstressed mowers. No contact is ultimate relief.

Equipment considerations

If you can think of your mower as a horse, regardless of its configuration, and if you appreciate that the real impact upon the turf is where the mower actually cuts the grass (that is, the cylinder and bottom blade), it becomes easier to disentangle the complex arguments. The braking effect of wrongly adjusted or overtightened cylinders often causes undue system load, resulting in engine wear, higher fuel consumption, heat gain to hydraulic systems, overload to seals and hoses, and otherwise unsatisfactory performance. For this reason, many manufacturers insist (quite rightly) upon maintaining relief on their cutting units. Now it is easy to understand the benefits of NO CONTACT - the ultimate relief.



The agronomic viewpoint

The condition in which a mower leaves a leaf blade has significant impact on overall plant health. We tend not to think much about what is going on at the microscopic level, where the grass is cut. But plant pathology research demonstrates how damaging the use of lapped (or otherwise improperly sharpened) cylinders can be. Poorly ground mowers tend to flail at the grass, leaving bleeding rough edges. A microscopic inspection of the leaf tip area reveals that a clean, scything cut made by a properly sharpened, non-lapped cylinder results in less leaf surface area exposed to pathogenic infection and lower transpiration rates. The plant can use more of its nutrients for root growth rather than damage repair.

Moving the maintenance program up a notch, avoiding “the mower doesn’t cut so we need to tighten it down a bit more” syndrome, can yield dramatic improvements (and savings) in several areas. Simply using a Rapid Facer to touch up the front face of the bottom blade every week on greens-mowers, every two weeks on tees, maybe monthly on fairway units - whatever works for you - will go a long way toward extending the functional life of a quality grind and save time by forestalling the need to lap.

Investing 1/2 hour every two months in sharpening - however you do it, with whatever machine you use - vs. spending four hours lapping over that two months (15 minutes twice per week) will yield even greater benefits to your overall agronomic and turf equipment maintenance.

Grass Blade Tips magnified x 75
Non lapped cut – left : Lapped mower cut - Right