

Installing a Successful drainage system

BY DR. JAMES MCAFEE

One of the most important aspects for sports field construction is designing the field for maximum drainage before and/or during an event.

Unfortunately, too many sports fields are constructed like the high school football field in the photo on the opposite page. These fields are constructed without an installed internal drainage system and don't have adequate crowns to remove excess moisture rapidly.

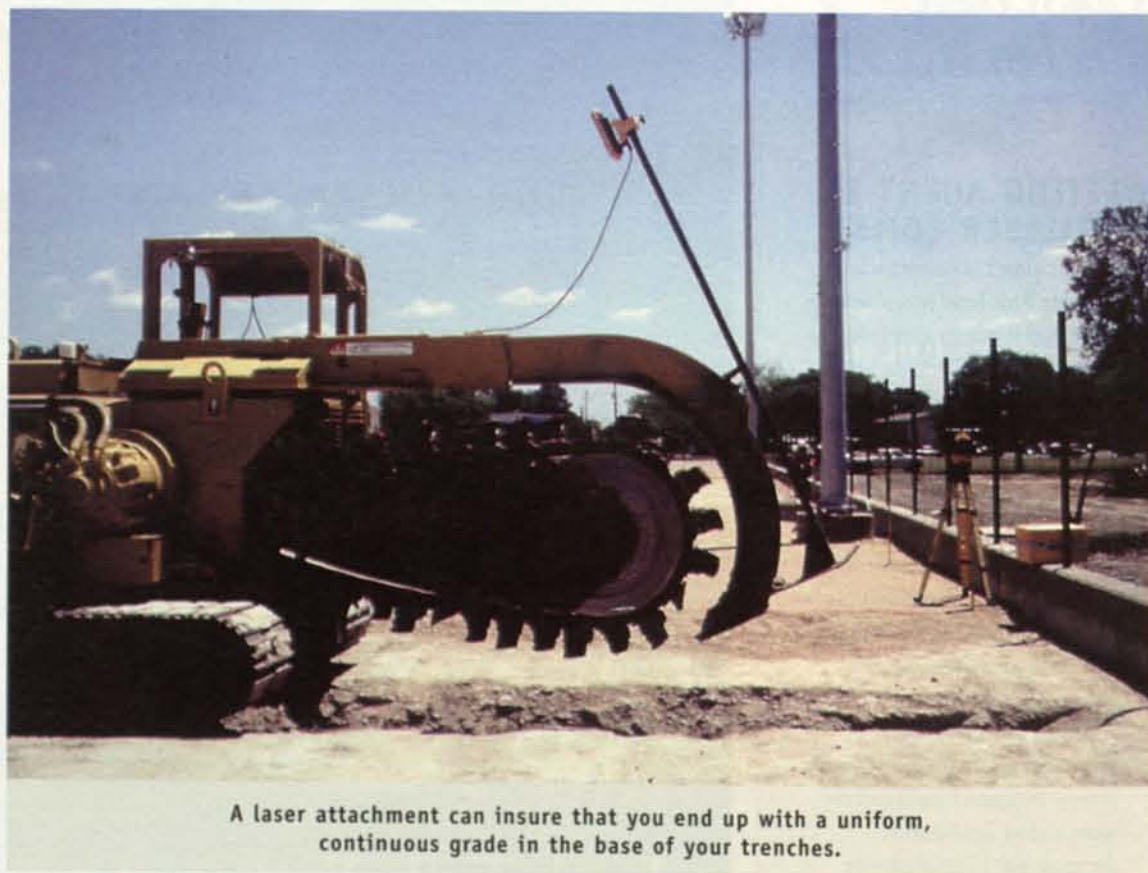
Once the topsoil on a sports field becomes saturated, the water will do one of two things, pond or run-off. In this case, the water starts ponding because there is no crown in the field. Playing games when the soil is saturated with water will cause severe damage to the playing surface and increase the amount of soil compaction, thus making the drainage problem with the field worse.

Over years of working with sports field construction, I have always been amazed at how little attention is given to this critical element, or how many times at the last minute the internal drainage system was removed from the original design specs to try and save money. Key factors to consider when designing drainage systems for a sports field include: moving water onto the field from surrounding areas; type of soil and soil depth; ability to remove excess water away from the field (storm sewer, creek, etc.); and weather factors such as rainfall. In areas of east Texas where average rainfall is 55-60 in. per year, proper drainage is going to be more critical than in areas of west Texas where average rainfall is 10-11 in. per year, for example.

First steps

One of the first steps in assuring proper drainage is to hire an architectural firm and/or contractor with extensive, specific experience. Just because someone knows how to run a grader doesn't mean they can build a sports field. It is important to have developed a very detailed set of specifications for the new field. I am also amazed at how many sports fields are built without any specs for soil type and depth, drainage system, irrigation, etc. Without these, when a problem arises, the school or city has no recourse to get the problem corrected.

Excess moisture is generally removed through surface run-off and/or through an installed internal drainage system. For fields built out of a native soil or an amended native soil, surface drainage is going to be the main removal means. For foot-



A laser attachment can insure that you end up with a uniform, continuous grade in the base of your trenches.

ball fields, the general guideline is to build a 12-18 in. crown in the center of the field with a continuous grade from the center to and past the sideline areas.

For sandy loam to loam soils, a 12-in. crown is normally sufficient grade (slope) to remove excess moisture. For fields built with clay type soils, it is recommended to construct an 18-in. crown in the center with a continuous grade from the center of the field to and past the sideline areas. It is important to install a drainage system on the sideline areas to remove the excess moisture there as well.

The image on page 26 shows installation of a 12-18 in. crown on a football field with a sideline drainage system. Note that many high school football and city park fields are also being used for soccer. If this is the case, then the slope for the field needs to extend well beyond the normal sideline area of the football field. If this is not done, then the sideline areas of the football field where the players stand during games becomes torn up and this will make a very poor playing surface for the soccer games.

For soccer fields built out of native soils, the recommendation is to provide for a 6-12 in. crown. While most soccer players prefer a 6-in. crown, they also don't like playing in a quagmire. If an internal drainage system cannot be included in a soccer field design, then it is best to use a 12-in. crown to insure good surface drainage.

While a crown in the center of football and/or soccer field is the most effective method to provide for surface drainage, it should be recognized that for some fields, surface drainage can be provided by sloping the entire field from sideline to sideline or from



Unfortunately, too many athletic fields are constructed without an installed internal drainage system and don't have adequate crowns to rapidly remove excess water.

endzone to endzone. The further the surface water has to flow to get off the field however, the less effective the drainage becomes.

For fields built with a proper sand mix, a 6-in. crown is generally the recommended guideline. Providing a continuous, uniform grade on the field is just as important as providing the correct height for the crown. Any low areas in the grade will disrupt the flow of surface water from the field. Improper grading and settling of the topsoil are the two main reasons for low areas occurring in the final grade.

Baseball fields

For baseball fields, the high point of the field should be the pitcher's mound, which is normally 10 inches higher than home plate. Then the field should be sloped in all four directions away from the mound at a 1.0 to 1.5% slope. As with football and soccer fields, this slope needs to continue to the sideline areas of the field and then some type of drainage system installed to remove excess moisture from this area.

Also, for baseball fields it is very important that this 1 to 1.5% slope continue across the skinned portions of the field and into the outfield. If constructed correctly, there will be very little movement of water down through the soil profile in the skinned area of the field. Surface drainage is the main method to remove excess water from this portion of the baseball field.

Another problem that often occurs on baseball fields is the build up of lips on the grass areas next to the skinned area; these lips will prevent water from flowing off the skinned area and into the grass. Regular maintenance will prevent this. From the skinned area, the field is then sloped at a 1 to 1.5% slope to the outfield fence.

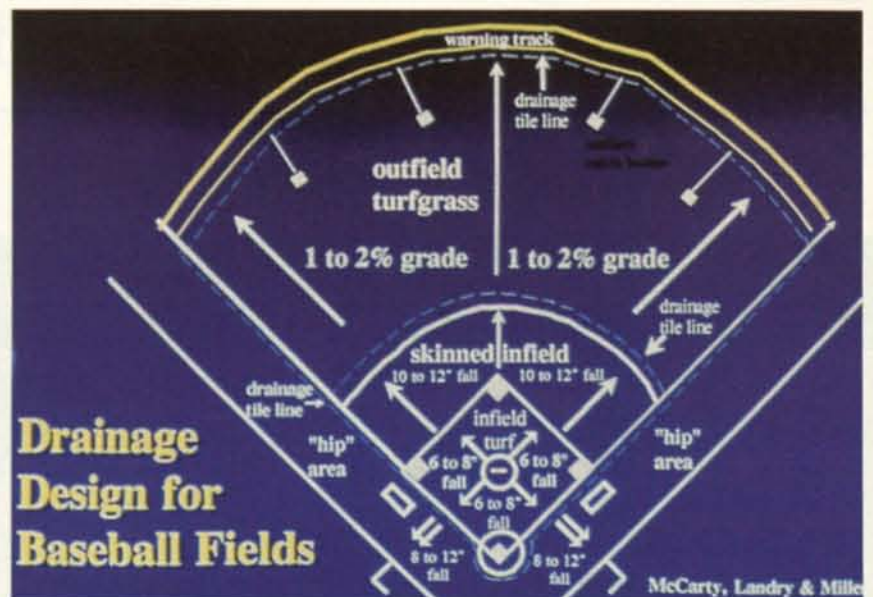
The image at right provides a basic guideline for grading a baseball field. For softball fields they are a couple of common ways to grade the field. The most common grade is to slope the entire field, starting at the backstop and going toward the outfield fences at a 0.6 to 1.0% slope.

A second method is to provide a level crown through the center of the softball field going from home plate to the pitchers mound through second base and then to center field. Then the field is sloped at a 1 to 1.5% grade from the center of the field toward the right sideline and from the center of the field to the left sideline. The

advantage of this design is that home plate and the pitcher's mound are at the same height, which for fast pitch softball is important.

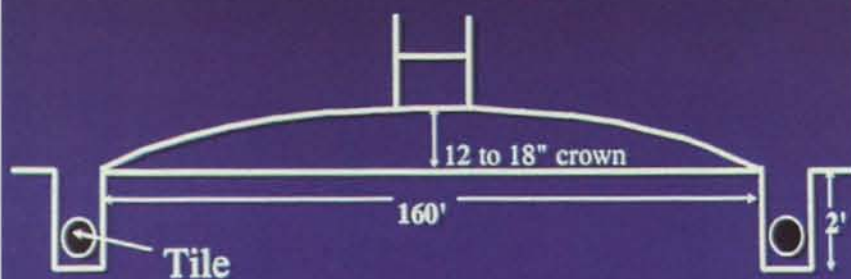
With the exception of sand-based fields, assuming that the correct sand is selected, the movement of water into the soil profile (infiltration) and then down through the profile (percolation) is very slow. The amount of pore space and type of pore space in the soil generally determine movement of water into and through a soil profile.

Macropores (large pores) provide for good drainage and good aeration, but provide for very little moisture retention. Micropores (small pores) provide for good moisture retention, but provide very little drainage and aeration. Sands used for sports field con-



Here's a basic guideline for grading a baseball field.

End Section Crown for Football Fields Constructed with Native Soil



McCarty, Landry & Miller

Schematic of installation of 12 to 18-in. crown on a football field with sideline drainage.

struction generally have more macropores and fewer micropores. While these soils provide for excellent internal drainage of excess moisture, they generally require more input of supplemental irrigation and fertilization to maintain a healthy stand of turfgrass.

On the other hand, native soils high in clay and/or silt content have a larger number of micropores and fewer macropores. Internal drainage of excess water on these type fields is very slow. Providing a crown for good surface drainage is a must for these fields. Before selecting a particular soil, send a sample to a certified soil testing lab to be tested for texture analysis, porosity, saturated hydraulic conductivity, and compressibility. This step is not an option but a must. While testing for physical characteristics of a soil is considerably more expensive than chemical analysis, the fee for these tests is a drop in the bucket compared to the overall costs of constructing a sports field.

Another step that is often overlooked by inexperienced contractors is removal of the excess moisture from the subgrade. Movement of water into the subgrade of the field can only occur once the topsoil profile becomes saturated. Then, drainage of the field occurs at percolation rate of water down through the subgrade, which as a rule is much slower than the percolation rate for the topsoil. If means are not provided to assist in removing excess water once it hits the subgrade, then the field will tend to hold water at the interface between the subgrade and the topsoil.

During heavy rainfall, the field then acts like a bathtub and fills up with water, thus dramatically increasing the amount of time required for the field to drain. On native soil fields, it is very important that the subgrade not be heavily compacted before placing the topsoil mix over the subgrade. This is often another mistake inexperienced contractors make. Compaction of the subgrade will further reduce the flow of water from the topsoil profile down into the subgrade, thus increasing the time required for removing excess moisture from the topsoil. While you do need a firm subgrade to prevent excess settling of the subgrade, do not heavily compact the subgrade before placing topsoil over the subgrade.

For sand-based fields, it is necessary to stabilize the subgrade with compaction. However, it is also important to install an internal drainage system in the field to remove excess water from the subgrade area of the field. Note, installation of an internal drainage system on fields built using native soils will also help in the removal of excess moisture from the subgrade, just not as well as a sand-based field.

Drain lines

Correctly installing drain lines is critical to the successful removal of excess moisture during heavy rainfall periods. Spacing for the trenches should be at a 15-20 ft. spacing for sand-based fields. However, on native soil fields I would recommend a maximum of 10-15 ft. spacing. The grade on the trench should have a minimum positive slope of 0.5% with 1.0% grade preferred. Note, use of trenchers with a laser attachment can insure that a uniform, continuous grade occurs in the base of the trench.

If any low areas occur in these trenches, this will impede the flow of water through the drain lines and thus allow the fine soil particles, silt and clay, to settle out in the bottom of the drain lines and eventually plug up the drain lines. In most cases, it is recommended to line the drainage trench with a plastic material to keep the silt and clay soil particles found in the subgrade from moving into the trenches, and thus slowing down the movement of water into the drainage pipe.

Next, place a 1-2 in. layer of fine gravel, 1/4 to 3/8 in. gravel, in the base of the trench. Place the plastic pipe used for drainage on top of the gravel layer and then top off the pipe with a minimum 1-2 in. layer of the same fine gravel. For most sports fields, a sand layer is then placed over the gravel to the top of the drainage trench in the subgrade. Again, remember that it is just as important to send samples of the gravel and sand used in the drainage trenches as the soil for topsoil to a certified lab for physical analysis.

Most sports fields today use the corrugated plastic pipe with fine slits in the plastic for the drainage system. However, if PVC pipe with a single row of holes in the pipe is used, it is very important to place the holes on the bottom of the trench to encourage faster movement of water. Note, the common size for drainage trenches in the subgrade of sports fields is a 6-in. width with a minimum 8-in. depth. The key is to make sure that the pipe is placed deep enough in the field so that aerification with a deep tine aerifier will not pierce the pipe. You might be surprised how often this actually happens. For most new football and soccer fields, the drain lines are installed lengthwise in the field which requires much less trenching and also allows for maximum interception of water flowing from the center of the field toward the sidelines.

Recently, I have been involved with the construction of a couple of sand-based baseball fields that used the flat corrugated pipe for drainage instead of the 4-in. round corrugated drainage pipe. Instead of digging trenches in the subgrade, they laid this pipe flat on the surface of the subgrade, covered the pipe with a 4-in. layer of fine gravel, and then placed the sand topsoil mix over the gravel. So far this has worked excellently. The key to this system is installing a uniform, continuous subgrade surface with no low areas. The slope should be a minimum of 1% with a 1.5% grade preferred. It is also critical that a layer of fine gravel be used to cover the pipe. Also, spacing for the drainage pipe should be placed at a 10-15 ft. spacing for best results. Note, I would not recommend using this type of drainage system for sport fields constructed using native soils and/or amended native soils.

ST

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Achieving successful drainage

1. Select an architect and/or contractor with experience in building sports fields.
2. Send the soil, sand, and gravel to be used in construction to a certified lab for physical analysis.
3. Construct a uniform grade on field surface to provide maximum surface drainage. This is especially critical for native soil fields.
4. Prevent any low areas from occurring in the field surface.
5. Install an internal drainage system.
6. Before construction, survey the site to determine any movement of water onto the field from neighboring sites. If this is a potential problem, then install interceptor drainage lines around the field to prevent such water movement.
7. Make sure excess water can be easily moved away from the field through storm sewers or natural areas such as a creek.



NEW TRIPLEX REEL TRIM MOWER

The Toro Reelmaster 2000-D is now available. Toro improved the 2300-D, making it more powerful and simpler to operate, behind its diesel Briggs & Stratton/Daihatsu 199 net hp engine. The additional power will increase the traction and mowing capabilities on sloped surfaces, trim and surround areas, as well as sports fields.

The engine and tranny are isolation-mounted to reduce vibration for the operator. An integrated PTO switch includes 3WD engagement to simplify operation, and means the operator doesn't have to hold a lever to drop the cutting units, because a detented lift valve provides a hit-to-drop function.

The Toro Company/952-888-8801

For information, circle 199



HEDGE TRIMMER

New from RedMax is the HTZ2500 single-sided hedge trimmer with a Komatsu Zenoah's Strato Charged engine. The 25.4 cc two-cycle unit is the only engine of its size that meets CARB II and EPA Phase 2 clean air standards without a catalytic converter, says the company.

The product's 30-in., dual reciprocating blades are at an ergonomic 1.62 pitch; blade speed is 3.85 ft. per second, and grips are positioned for best operator comfort.

RedMax/800-291-8251

For information, circle 200



VACUUM VEHICLE

Broyhill's dedicated vacuum vehicle VacMate has improvements this year. It now features an 8-in. suction hose arm control and a belt-driven blower assembly that reduces noise, vibration, and extends performance of the 13-hp engine. Both stick shift and automatic drive are available, both with power steering.

Broyhill/800-228-1003

For information, circle 198



NEW VERTI-CUTTER

First Products has a new verti-cutter designed for continuous heavy-duty operation on fairways, tees, and more. The unit has a swing hitch that allows you to verticut around objects while turning. Pivot points in the hitch allow the unit to "float" over uneven terrain.

When the unit is lifted, it automatically centers itself and locks for transporting. Removing thatch and other dead material allows more room for growth and healthier turf.

First Products/800-363-8780
For information, circle 190



EQUIPMENT IN ONE WAY AND OUT THE OTHER

All-new trailer design eliminates the need to back equipment on or off ramps, saving inconvenience, damage, and injury.

Tongue Twister, manufacturer of trailers for recreational, automotive, construction and utility equipment, announces a new technology in trailer systems that totally eliminates the hazardous backing of, landscaping and utility equipment up or down trailer ramps. Employing a patent-pending, swivel design, Tongue Twister enables users to easily pivot the trailer without unhitching it, allowing vehicles to be safely driven directly onto and off the trailer via straight-through front and rear ramp access.

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WALK-BEHIND OVERSEEDER

Gandy Company offers a 20-in. self-propelled Slice n' Seed walk-behind overseeder for repairing or re-establishing grass in worn areas or establishing new grass varieties. The unit features an 8-hp Honda engine with centrifugal clutch, which is capable of covering 22,000 sq. ft. per hour. Seeding width is 20 in., with 9-in. heat-treated slicing blades on 2-in. centers.

The seed box features a stainless steel bottom and slide with internal rotor driven by front wheel drive; a cam gauge sets opening size to meter all types of grass seed while a hand lever is used to shut off flow. Internal rotor bar and the metering bottom can be removed for servicing.

The .83 cu. ft. seed box can be ordered with traditional 10-in. disks to hold open the slit created by the slicing blades, or with a seed shoe assembly creating a slightly wider slit but placing a higher percentage of seed into the ground.

Gandy Company/800-443-2476
For information, circle 197



SPREADER

SpreadEx, division of TrynEx International, has introduced its new LG 375 commercial-duty granular spreader, designed for the turf market. Standard with a 10-ft. control cable, the spreader's material flow gate calibrates and controls material flow and allows the operator to distribute the right amount of material for each individual application, says the company. An adjustable deflector allows for spread pattern manipulation.

Designed to work with tractors, utility vehicles, riding mowers, trailers, and pickups, the LG 375 comes standard with a 2-in. receiver hitch mount. Optional three-point hitch, drop utility, and trailer mounts are available. No belts, pulleys or chains limit downtime. Holding up to 3.25 cu. ft. or 275 lbs. of dry, free-flowing granular material, the unit's 10-in. steel spinner can spread up to 40 ft. wide.

TrynEx International/800-725-8377
For information, circle 196



36-FT. SEEDER

Brillion Farm Equipment has tripled the width of the Turfmaker Seeder to an industry-first 36 ft. Now this accurate seed metering system also delivers the widest footprint. At a planting rate of 1 lb. per 1,000 sq. ft. and a speed of 5.5 mph, this unit with its 69 bushel total hopper capacity can cover 24 acres per hour and 90 acres between refills, says Brillion.

Brillion studies show that the seeder reduces passes over the field and cuts total refilling time to yield a more than a 350 percent increase in efficiency over a standard 12-ft. seeder. Transportation is also more efficient because the three-section seeder folds hydraulically to a 15-ft. transport width.

The new, larger size uses Brillion's Micro-Meter fluted feed cup system that delivers precise seeding rates as low as 0.09 lbs. per 1,000 sq. ft. and as high as 2.16 lbs. per 1,000 sq. ft. (with the standard speed-up kit).

The seeder lives up to the Brillion reputation for durability and reliability, with heavy construction and reinforced stress points. Standard features include an electric clutch that provides on/off control from the tractor seat without raising and lowering the seeder; a rear walkboard makes for easier seed loading; and a safety light kit makes transportation safer.

Brillion Farm Equipment Division/800-409-9749
For information, circle 193



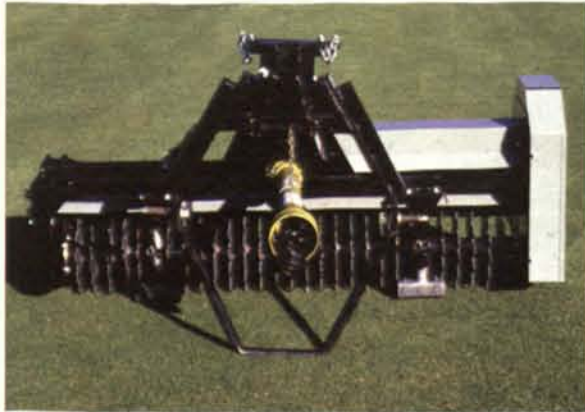
MID-CUT MOWERS

Encore's Prowler mid cuts have a dual path hydrostatic drive and full floating deck suspension (52-, 61-, and 72-in. decks available). This is a front-cut style deck suspension on a mid-mount, the company points out. The full floating deck follows terrain with the front wheels but independent of the mower to improve the cut on rough terrain and reduce scalping.

To give a level cut at even high speeds, there's a PTO shaft feeding power to the blades and a heavy-gauge welded steel deck with special reinforcement channels controlling vibration. The deep deck, a full 5 1/2 in., handles grass better than shallower decks. All units feature blade spindle assembly for longer bearing life and easier routine maintenance.

Encore Mfg./800-247-4255
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Maintaining the Grounds



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Land Pride/785-823-3276
For information, circle 192



DOUBLE CUTTING WIDTH

The Swisher 44-in. Trailmower can attach to your tractor and act as a wing mower, doubling your cutting width, says the company. Other features include: single point cutting height adjustment; 44-in. cutting deck; Tecumseh or Briggs & Stratton engine options; adjusts to match tractor cutting height; twin blades for a finished cut; bumper roller system protects against damage to trees and shrubs; left to right offset hitch for mowing ditches or low hanging trees; and anti-scalp rollers.

Swisher/660/747-8183

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MINI GROUNDS PLANE

This mini grounds plane levels as well as grooms. Three models are available, 4-, 5-, and 6-ft. The units are designed for sports fields and bike/running paths, and are equipped with mechanical positioner, leveling blade, and finishing broom. Options include ripper with positioner, custom-built tillage, electric lift and control, and hydraulic cylinder with hoses.

WINDS/309-465-7655

For information, circle 202



SOLID STEEL BODY & FRAME

Snapper's SPLH171KW has a solid steel body and frame. It also features a 17-hp OHV Kawasaki engine and Accutrac on-the-go fingertip hydrostatic drive control with comfort-loop steering. The full-floating deck with easy height-of-cut adjustment is constructed with 7-gauge (3/16-in.) steel. Also included is the field-serviceable spindle assembly for ease of repair. The patented Ninja Mulching System can be added to the deck to leave lawns looking manicured without bags of grass clippings.

Snapper/800-762-7737

For information, circle 204



DINGO'S STUMP GRINDER QUITE A SIGHT

I witnessed a demonstration of Toro's Dingo TX 425 compact utility loader's stump grinder attachment and Toro just tore it up. In just a few minutes and maybe a half dozen cuts, this unit had dug a hole big enough for three kegs of beer. The grinder has a 17-in. cutter wheel with 12 cutting teeth, a wheel speed of 2,000 rpm, and a tooth tip speed of 148 ft. per second—all

of which combines to dig a big hole while the operator looks like he's comfortable enough to have a sandwich. You can position the wheel index at a 30-degree angle too, to get at those troublesome roots.

The operator showed me how easy it is to attach tools to the Dingo; even I can turn two locking pins and connect two hydraulic lines. Key also is that you can fit the Dingo in places where traditional grinders can't go—that's saving money and time.—Eric Schroder

The Toro Company/
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