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# Equipment used for Maintaining Turf Grass

Understanding how turf maintenance machinery works is just as important as understanding the turf it is used on. If a turf machines limitations or settings are not understood then it is likely poor results on the turf will occur

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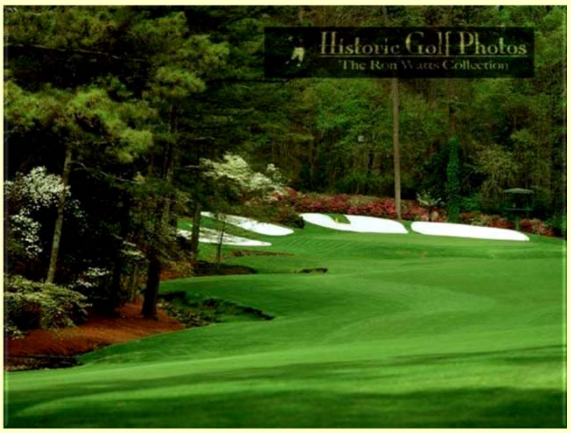
# Aftercut Appearance

- Objective of turf manager
  - High quality appearance of turf
  - Complementing the surrounding environment.
- Key Factors
  - Reel mower
  - Rotary mower

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# Reel Mowers

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# Reel Mowers

- All reel mowers are only 70% ~ 80% efficient at removing all the grass to the effective height of cut
- Due to cutting action
- The effective HOC is measured at the lowest point to the ground. The grass above this is due to the inefficiency of all reel mowers


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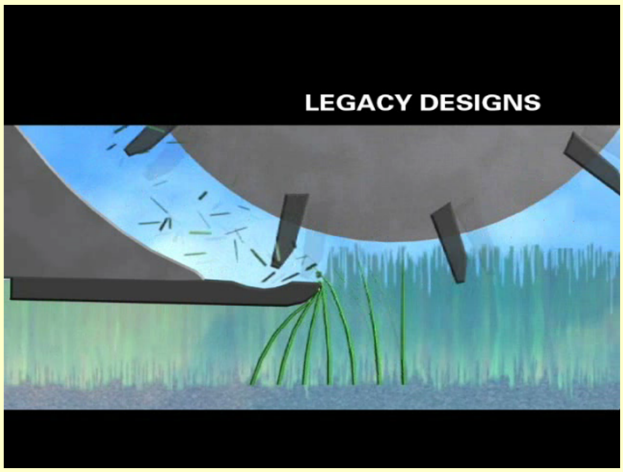
# Reel Mowers

- Using high reel speeds to increase the clip rate damages the turf.



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# Reel Mowers

•Using high mow speeds to increase productivity increases reel inefficiency and lowers aftercut appearance the turf.

Correct [redacted] speed

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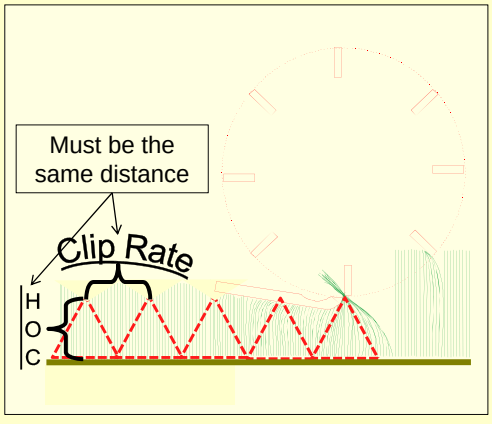
# Reel Mowers

•Manufactures of reel mowers have found that the best aftercut appearance and efficiency of the reel on any turf type is obtained when the clip spacing matches the height of cut.

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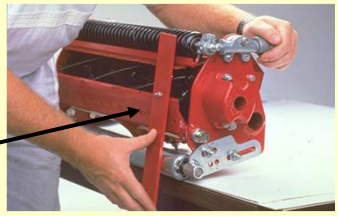
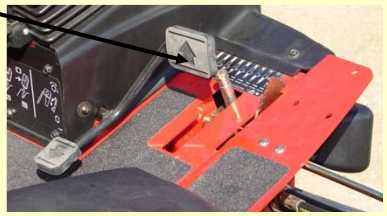
# Reel Mowers

Reel mowers are fitted with reel speed controls so the clip rate can be adjusted to match the cutting height and mow speed

Reel Speed Controls



Height of Cut



Ground Speed

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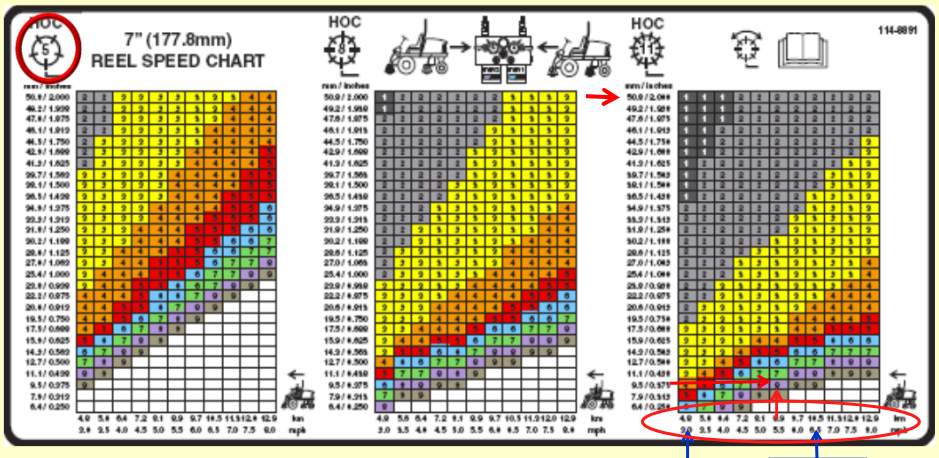
# Reel Mowers



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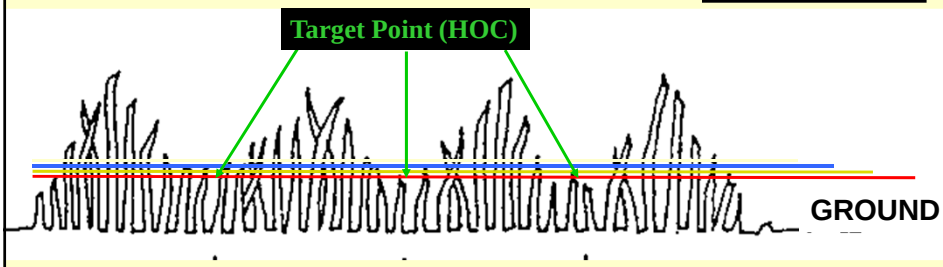
# Reel Mowers

* Double Cut
* Triple Cut
* Quad Cut

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# KEEPING THE REELS AND BEDKNIVES SHARP

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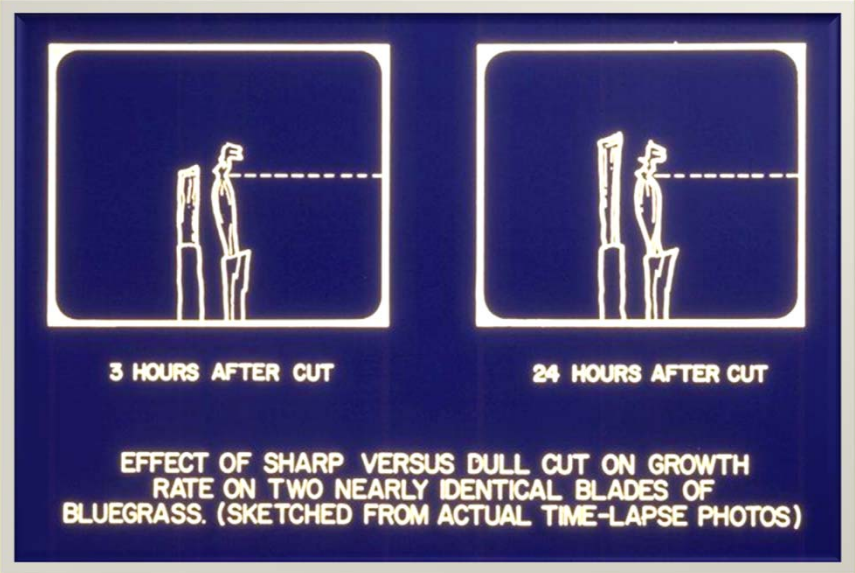
# Sharp *vs* Dull

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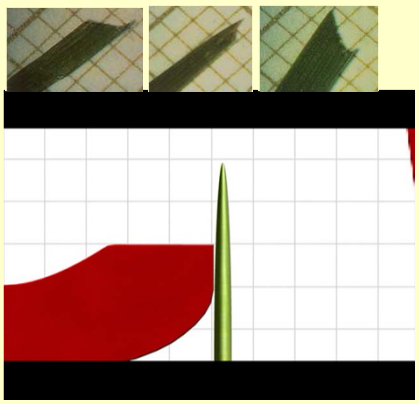
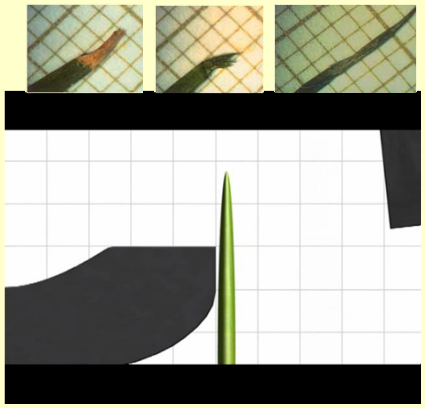
# To keep reels and bedknifes sharp;

## 1. Maintain Proper ADJUSTMENT.



Properly adjusted reels stay sharper for longer and do less damaged to the turf



Improperly adjusted reels dull quickly and cause excessive damaged to the turf

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# To keep reels and bedknifes sharp;

## 2. BACKLAP the Reel and Bedknife

**Approximately Two ~ Five Minutes per Cutting Unit**

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# To keep reels and bedknifes sharp;

## 2a.Occasionally face the bedknifes

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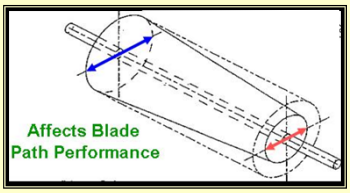
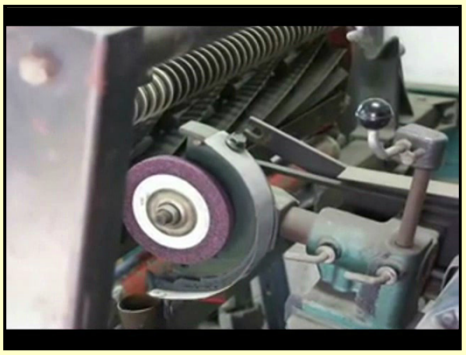
# To keep reels and bedknifes sharp;

## 3. GRIND the Reel and Bedknife.

Without access to a reel and bedknife grinder it will be impossible to maintain reels in good condition.
Backlapping a reel to sharpen it is not a solution to reel grinding.

Reel grinding is a **3 step** process
1. Reshape the reel into a perfect cylinder.
2. Sharpen the reel
3. Relief grind the reel



## When Is It Time To Grind

**8" - 10" Diameter ROUGH MOWER reels:** Should be lapped "as needed"; if estimated use totals 15-20 hours per week, you should grind approximately every 400-500 hours, or once every six to eight months.

**5" - 7" Diameter FAIRWAY reels:** Should be lapped as needed"; if estimated use totals 20-30 hours per week, you should grind approximately every 375-425 hours, or once every four to six months.

**5" Diameter GREENS & TEE MOWER reels**: Should be lapped "as needed"; if estimated use is five to seven times per week, averaging 15-25 hours, you should grind approximately every 200 to 250 hours, or once every three to four months.

The grind intervals noted above are strictly estimates. The need to grind will depend on course conditions, top-dressing practices, adjustments, backlapping or non-backlapping practices, relief grinding practices, and ultimately, the judgment of desired cut quality.

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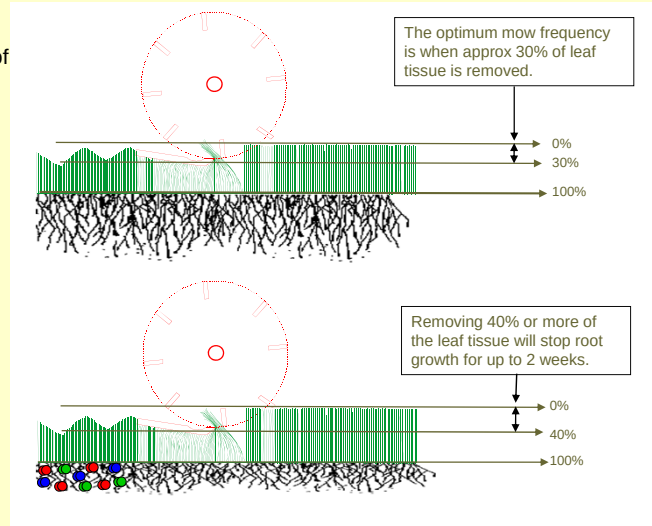
# Turf plant stress increases with infrequent mowing

The standing rule for mowing is setting a mow frequency that never removes more than 1/3rd of the leaf.

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# Cutting Unit Accessories

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# ACA and Agronomic Practices

- Cutting unit effect with grain, thatch and puffiness (scalping & height mismatch)

# Questions about Reel Mowers

# NEXT ROTARY MOWERS

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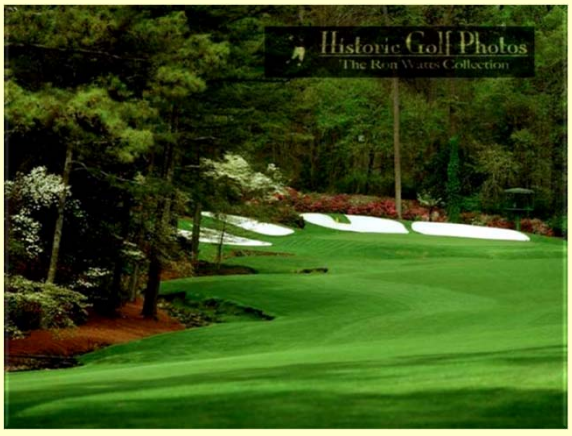
## Rotary Mowers

•Rotary mowers are also a key factor in enabling a high quality aftercut appearance and health of the turf.



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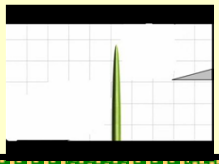
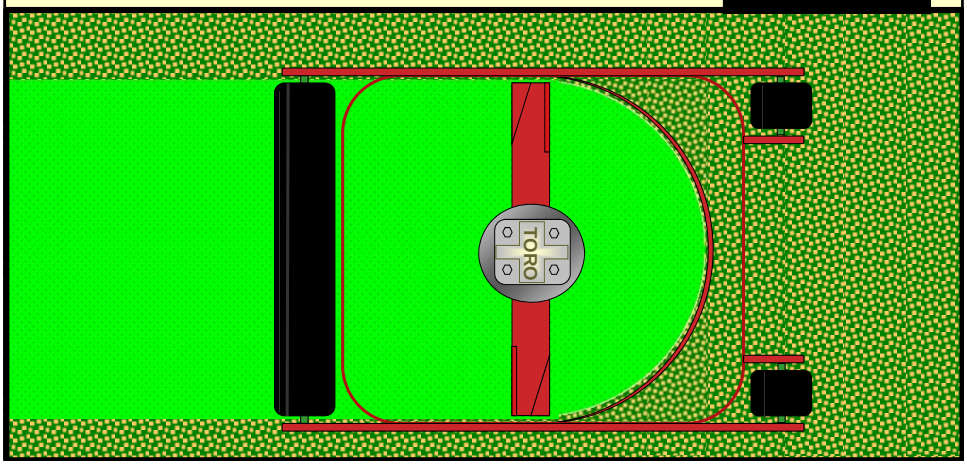
# Rotary Mowers

All rotary mowers use a single sharp blade travelling at high speed to cut the grass.
A small amount of leaf tip damage is unavoidable when using a rotary mower.



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# Rotary Mowers

The main difference between rotary mower types is the design of the deck shell that encloses the blade and where the grass clippings are thrown from the blades.

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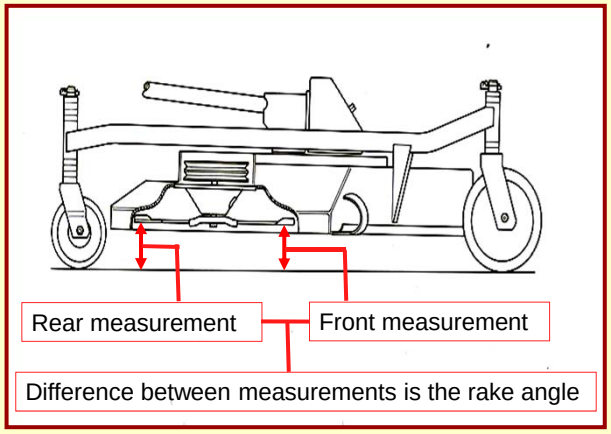
# Rotary Mowers

The rake angle of the blade on a rotary is an important adjustment. The rake angle is the difference in height from the front of the blade to the rear of the blade.

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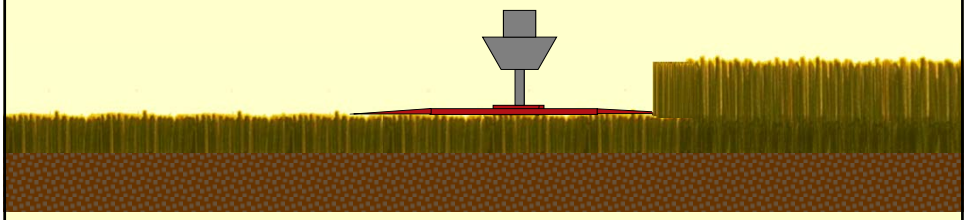
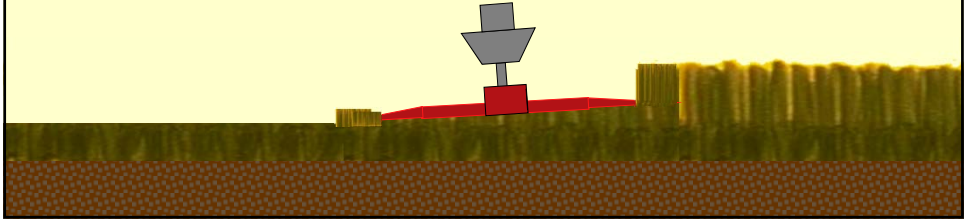
# Rotary Mowers

If the rake angle is to flat the entire blade rubs on the turf which can damage it and cause an unsatisfactory aftercut appearance.



If the rake angle is towards the rear of the blade it will double cut the grass causing it additional mowing stress. It also places more than twice the strain on the entire mower causing premature wear on all components



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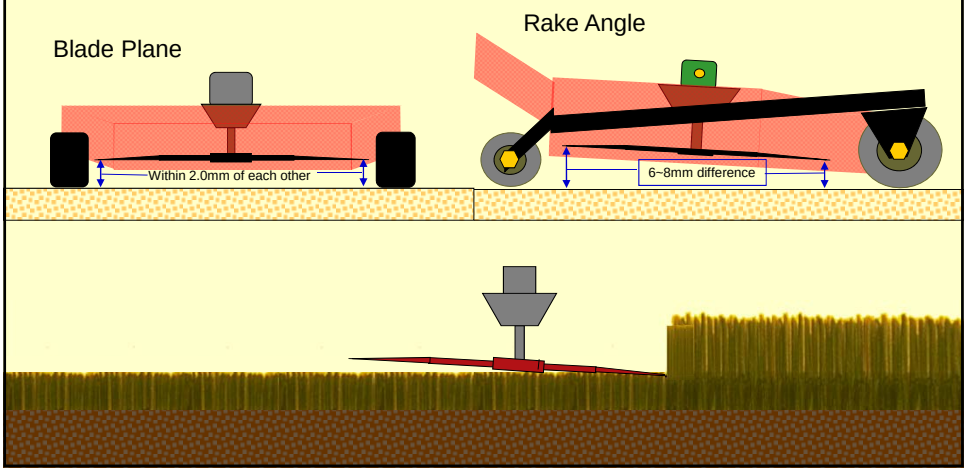
# Rotary Mowers

The least amount of turf damage and stress is achieved when the rake angle is between 6~8mm difference from front to rear.
Each blade must also be within 2.0mm of each other




# Questions about Rotary Mowers

## NEXT
## AERATORS & TINES

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# Aerators

- **Due to modern turf cultural practice's the use of aeration equipment has increased dramatically over the last several years**


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# Aerators

**Break into 3 categories**

- **Light-Duty (<200mm)**
  - **Relieve mild compaction**
  - **Change soil profile**
  - **Minor air / gas exchange**

- **Mid-Duty (200-300mm)**
  - **Increase Drainage**
  - **Relieve "cultivation pan" compaction**
  - **Increase air/gas exchange**
  - **Encourage deep root growth in light/medium soils**

- **Heavy-Duty (300-400mm)**
  - **All of Mid-Duty Benefits**
  - **Encourage deep root growth in heavy soils (Clay or fine texture)**
  - **Relieve compaction from construction**

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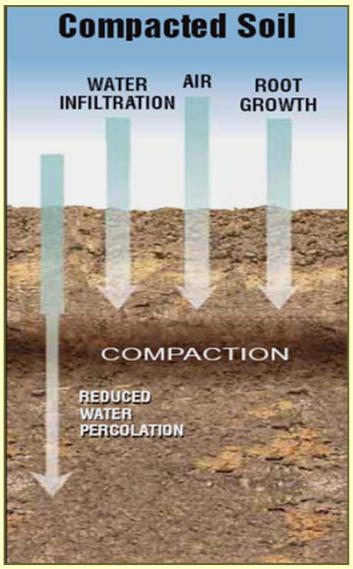
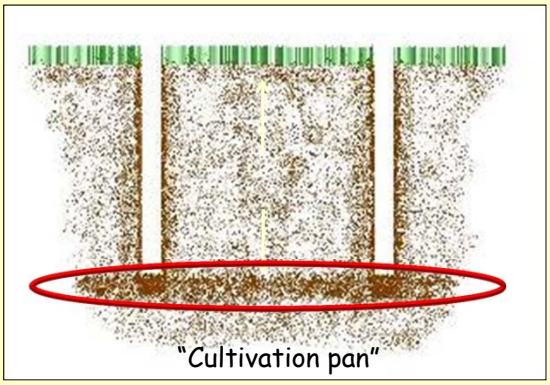
# Light Duty Aeration




Repeated light duty aeration creates a cultivation pan that inhibits deep root growth, drainage and deep air/gas exchange.

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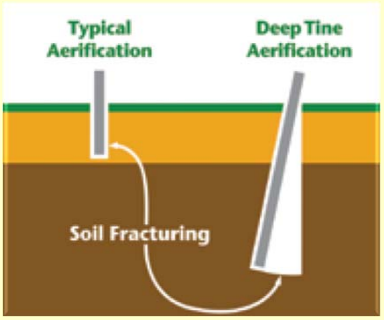
# Heavy Duty Aeration

- **Mid to Heavy Duty** (deep tine) **aeration begins at 200mm and can reach depths of up to 400mm**
  - **Solid or Core Tine**
  - **Mid-Duty (200-300mm), Heavy-Duty (300-400mm)**
- **Primary Benefits**
  - **Break through "Cultivation Pan"**
    - **Increase Drainage**
    - **Increase Deep Root Growth**
  - **Relieve Deep Compaction**
    - **Increase Deep Gas Exchange**
  - **Soil Fracturing**



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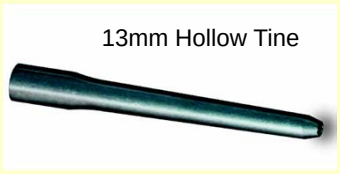
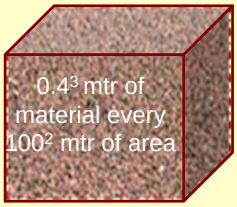
# Hollow Tine Aeration

The primary objective of the hollow tine is to maximize drainage and increase the soils air/gas exchange ability to encourage deep root growth.

## Soil Modification & Compaction Alleviation

A 13mm Hollow Tine Coring 36 Holes every $0.1^2$ metres at a depth of 75mm will remove $0.4^3$ metres of material per $100^2$ metres of Surface Area

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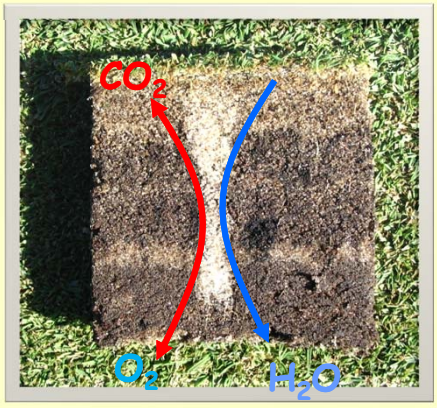
# Hollow Tine Aeration

As turf conditions vary a large number of hollow tines are available to suit the turf conditions.
Selecting a hollow tine is usually a case of experimentation to find which tine works best for the condition.
If hole quality or poor core removal is an issue slowing down the aerator or hydrating the area to be aerated often helps with core removal and hole quality.



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# Solid Tine Aeration

Soil scientists agree that solid tine aeration should be an integral part of a good turf management

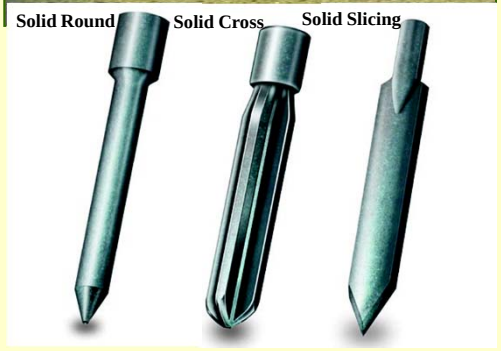
Benefits:

Relieves in season "*Surface Tension*"

Minimizes turf surface disruption

Enhances water infiltration

Can be performed anytime throughout the growing season.

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# Solid Tine Aeration

**Solid Round Tines**

•Produce some surface / subsurface compaction.
•Turf is cylindrically compressed as the tine is driven into the turf.

***Benefits:***

•Cylindrically shaped hole easily accepts sand.
•Minimal sand bridging results (air pockets).
•Enhances nutrient and chemical "wicking".

*Effects on the turf vary between solid tine types:*

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# Solid Tine Aeration

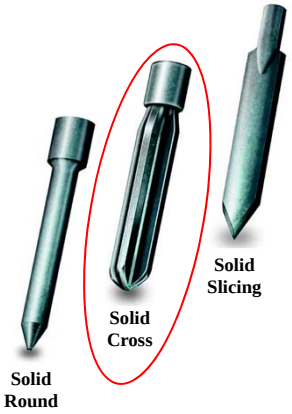
**Solid Cross Tines**

•Turf's surface and subsurface is only slightly compressed as the tine is driven into the turf.
•Due to multiple cross shape, compaction is greatly reduced but course top dressing materials can cause some bridging resulting in air pockets.

***Benefits:***

•Creates less compaction compared to solid round tines.
•Root severing is greatly enhanced to promote root branching that contributes to a stronger, healthier root mass.

*Effects on the turf vary between solid tine types:*

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Solid Tine Aeration

**Solid Slicing Tines** (bayonet)

•Creates very minimal compaction within the walls of the vent cavity.
•Difficult to fill cavity with top dressing materials.

***Benefits:***

•Solid Slicing tines cause low disruption to the turf surface.
•Adequate root severing is obtained
•Vent cavity remains open longer, compared to round or cross tine which enhances water infiltration and gas exchange.

*Effects on the turf vary between solid tine types:*

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# Solid Tine Aeration

**Needle/Pencil** tines create minimal compaction within the walls of the cavity.

****Benefits:***

On greens, needle/pencil tines cause very low disruption to the turf surface and the cavity remains open long enough for water infiltration and gas exchange during the playing season.

Needle tine

5mm or 8mm

# Questions about Aerators & Tines

## NEXT

## TOP DRESSERS

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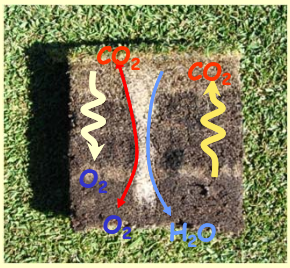
# Top Dressers

***Top Dressing helps accomplish several objectives…***

- **Thatch Control**
- **Improved Drainage**
- **Smoothing surface irregularities**
- **Modifying the surface soil**
- **Protection of the turf plant**

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# Top Dressers

Ultra Light

Light

Medium Light

Medium

Medium Heavy

Ultra Heavy

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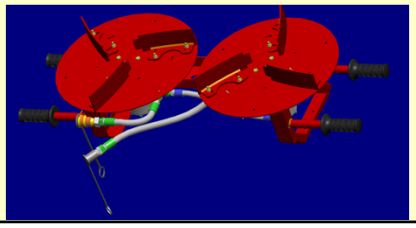
## Function of a spinner Top-Dresser

A spinner style top dresser is a relatively simple machine.

- It consists of a hopper mounted over a conveyer belt.
- The conveyer belt pushes the top dressing material through a metering gate at the back of the hopper.
- The metered top dressing material is then dropped onto the rotating spinners.
- Attached to the spinners are the broadcast paddles which evenly distribute the material over the broadcast area.

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## Operation

- **The material spread density and pattern are determined by vehicle speed, spinner speed, spinner blade angle and tailgate height.**

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# Top Dressing Objective

**Goal is to apply sand to the turf consistently over time**

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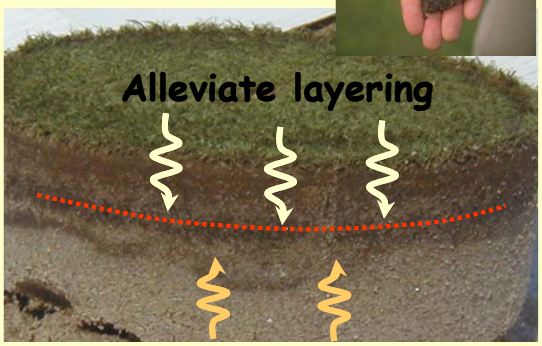
# Top Dressing Practices

## Light and Frequent Topdressing

- It is important to attempt to top dress with similar particles and materials that the root zone was constructed with.
- This will decrease the possibility of “layering”.

- Improve the Turf Agronomics
- Successful “dusting” programs demand that sand be applied to match the growth rate of the turf



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# Top Dressing Practices

## Light and Frequent Topdressing

- **Reduction of thatch without the “down time” that results from larger scale renovation.**

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# Light and Frequent Topdressing

- **Topdressing of 18 greens in less than 2 hours.**
- **Minimal disruption to play**
- **Can usually be watered in with a light irrigation application**
- **Sand does not get in the reels, therefore does not increase maintenance costs**

# Questions about Top-Dressers

## NEXT
## SPRAY SYSTEMS

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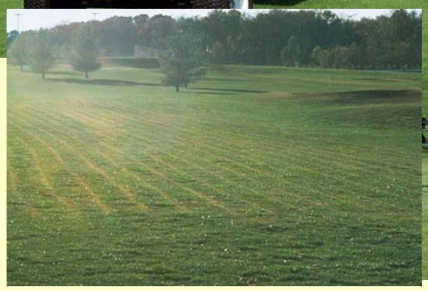
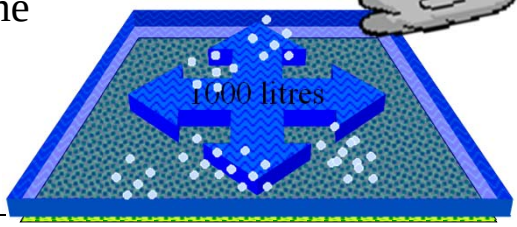
## Sprayers



TORO. Count on it.

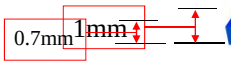
# Basic Spray Theo

Area + Specified Volume
= Application Rate
= Depth of volume over the Target Area




Target Area = 1 hectare

Example;



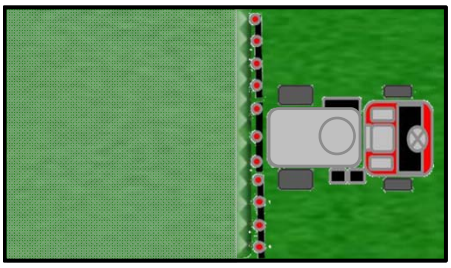

An application rate of 1000 litres over 1 hectare would equal a 1mm depth of chemical over the target area.

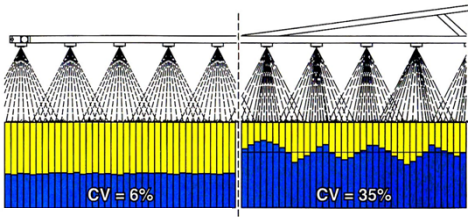
That's If you Get 100% Accuracy.

TORO. Count on it.

# Basic Spray Theory

- The accuracy of any spray system depends on;
  - the calibration of the speed and flow settings for a particular Application Rate
  - the condition of the nozzles and the type/size used






**Correct nozzle size and type in good condition**

**Incorrect nozzle size, type or worn condition**

# Nozzle Selection

**Things to be considered when choosing a nozzle**

- Spray Pattern
- Overlap
- Type
- Size
- Droplet size
  Contact or Systemic
- Drift

# Nozzle Size

Choosing the nozzle size is done by using this formula, (Litres per Hectare)

$$\frac{\text{Application rate } \mathbf{X} \text{ Target Speed } \mathbf{X} \text{ nozzle spacing}}{60{,}000} = \text{Litres per minute per nozzle}$$

Example;

910 x 5 x 50 / 60,000 = 3.79 litres per minute per nozzle

910 x 8 x 50 / 60,000 = 6.16 litres per minute per nozzle

# Nozzle Size

When using nozzle charts;

- Avoid using the speed charts
- Use the nozzle L/min to find the flow rate required
- Use the pressure to choose the most efficient spray pressure for the nozzle type
- Using the Example from the previous slide; an application rate of 910Lph at a target speed of 5 Km/h a size 1.0 nozzle would produce 2.8 bar at this application rate making it the ideal nozzle to use
- At the same application rate but at 8 Km/h a size 1.5 at 3 bar would be a better choice

| TORO Part No. | Nozzle Number / Color Code | Pressure (kPa) | Capacity 1 Nozzle (L/min) | Liters per Hectare at 50 cm Spacings | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FIRST | | SECOND | | | THIRD | | | |
| | | | | 4 km/h | 5 km/h | 6 km/h | 7 km/h | 8 km/h | 9 km/h | 10 km/h | 11 km/h | |
| 95-2225 | 1/4TTJ08-VS White | 150 | 2.23 | 669 | 535 | 446 | 382 | 335 | 297 | 268 | 243 | |
| | | 200 | 2.58 | 773 | 618 | 515 | 442 | 386 | 343 | 309 | 281 | |
| | | 275 | 3.02 | 905 | 725 | 604 | 518 | 453 | 403 | 362 | 329 | |
| | | 350 | 3.41 | 1023 | 818 | 681 | 584 | 511 | 454 | 409 | 372 | |
| | | 415 | 3.71 | 1113 | 890 | 742 | 636 | 556 | 495 | 445 | 405 | |
| | | 480 | 3.99 | 1197 | 958 | 798 | 684 | 598 | ---- | 479 | 435 | |
| | | 555 | 4.29 | 1287 | 1030 | 858 | 735 | 644 | ---- | 515 | 468 | |
| | | 630 | 4.57 | 1371 | 1097 | 914 | 784 | 686 | ---- | ---- | 499 | |
| | | 705 | 4.84 | 1451 | 1161 | 967 | 829 | 725 | ---- | ---- | ---- | |
| | | 780 | 5.09 | 1526 | 1221 | 1017 | 872 | 763 | ---- | ---- | ---- | |
| | | 855 | 5.33 | 1598 | 1278 | ---- | 913 | 799 | ---- | ---- | ---- | |
| | | 930 | 5.55 | 1666 | 1333 | ---- | 952 | 833 | ---- | ---- | ---- | |
| | | 1005 | 5.77 | 1732 | 1386 | ---- | 990 | 866 | ---- | ---- | ---- | |
| | | 1080 | 5.98 | ---- | 1436 | ---- | 1026 | 898 | ---- | ---- | ---- | |
| 95-9188 | 1/4TTJ10-VS Light Blue | 150 | 2.79 | 838 | 670 | 558 | 479 | 419 | 372 | 335 | 305 | |
| | | 200 | 3.22 | 967 | 774 | 645 | 553 | 484 | 430 | 387 | 352 | |
| | | 275 | 3.78 | 1134 | 907 | 756 | 648 | 567 | 504 | 454 | 412 | |
| | | 350 | 4.26 | 1279 | 1023 | 853 | 731 | 640 | ---- | 512 | 465 | |
| | | 415 | 4.64 | 1393 | 1114 | 929 | 796 | 697 | ---- | ---- | 507 | |
| | | 480 | 4.99 | 1498 | 1199 | 999 | 856 | 749 | ---- | ---- | ---- | |
| | | 555 | 5.37 | 1611 | 1289 | ---- | 921 | 805 | ---- | ---- | ---- | |
| | | 630 | 5.72 | 1716 | 1373 | ---- | 981 | 858 | ---- | ---- | ---- | |
| | | 705 | 6.05 | ---- | 1453 | ---- | ---- | 908 | ---- | ---- | ---- | |
| | | 780 | 6.37 | ---- | 1528 | ---- | ---- | 955 | ---- | ---- | ---- | |
| | | 855 | 6.67 | ---- | 1600 | ---- | ---- | 1000 | ---- | ---- | ---- | |
| | | 930 | 6.95 | ---- | 1668 | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 1005 | 7.23 | ---- | 1734 | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 1080 | 7.49 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| 95-9226 | 1/4TTJ15-VS Light Green | 150 | 4.19 | 1256 | 1005 | 838 | 718 | 628 | ---- | 503 | 457 | |
| | | 200 | 4.84 | 1451 | 1160 | 967 | 829 | 725 | ---- | ---- | ---- | |
| | | 275 | 5.67 | 1701 | 1361 | ---- | 972 | 851 | ---- | ---- | ---- | |
| | | 350 | 6.40 | ---- | 1535 | ---- | ---- | 959 | ---- | ---- | ---- | |
| | | 415 | 6.97 | ---- | 1672 | ---- | ---- | 1045 | ---- | ---- | ---- | |
| | | 480 | 7.49 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 555 | 8.05 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 630 | 8.58 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 705 | 9.08 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 780 | 9.55 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 855 | 10.00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 930 | 10.43 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 1005 | 10.84 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | | 1080 | 11.24 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |

# Droplet Size

## Droplet Size Categories @ 3 bar (45psi)

| Category | Symbol | Color Code | Approximate VMD Range | Applications |
|---|---|---|---|---|
| Very Fine | VF | Red | < 150 | Insecticides & Fungicides |
| Fine | F | Orange | 150 – 250 | |
| Medium | M | Yellow | 250 – 350 | Herbicides |
| Coarse | C | Blue | 350 – 450 | |
| Very Coarse | VC | Green | 450 – 550 | Soil Application of Herbicides |
| Extremely Coarse | XC | White | > 550 | |

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# Conclusion

To help ensure excellent results from turf maintenance equipment it is essential that proper consultation with the sales staff of your equipment provider is undertaken at the time of purchase.
Be sure to make them aware of what it is you want to achieve and show them the area you intend to use the equipment in.
They can then provide you with accurate information on the best type of machine and accessories you need to get the results you want

# Questions
# *Thank You!*

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