Precision Management

IPM GPS GIS

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Precision Management

• Observations
• Documentation
• Mapping
• Management

IPM

IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks.

GPS GIS

• GPS – Global Positioning System
  – Locate a position on the earth’s surface
  – Locate a pattern or shape on the earth’s surface
• GIS – Geographic Information System
  – A database of coordinates and associated features
  – Adds value to GPS data
The Future

- Smart equipment
  - GPS enabled
  - Sensors mounted on equipment
  - Full course surveys without additional survey personnel
- GIS fully integrated into recordkeeping and course assessment
- Irrigation, pest, and other management practices documented
- Management improved, inputs optimized

Green Seeker with Ipaq and GPS receiver
Trimble AgGPS132 GPS, BB Electronics RS232 Multiplexer

TDR-300 and EM38 Soil moisture measurements taken every 2 ft between irrigation heads

Correlation VWC vs dS/m

Geonics EM38 dS/m
LED light sources are modulated at a high frequency to allow the sensors to ignore ambient light NIR 770 nm, Red 656 nm, Green 525 nm

**SPECTRUM CM1000 CHLOROPHYLL METER**

**WHAT IT DOES:**
- Objective measure of turf quality (color, density)
- Early detection of pest, nutritional problems
- Scheduling fertilizer applications?

Turf quality = 2.71 X ln (meter reading) - 9.71

\[ r^2 = 0.73 \text{ (p<0.001)} \]
EM38 & NTech GreenSeeker Normalized Difference Vegetative Index (NDVI)

Temporal-Spatial Variation:
Effect of irrigation on soil moisture levels, soil moisture distribution and turf quality
Barona Creek Inn Golf Club
Lakeside, CA  Sandy Clark, CGCS

• Three fairways evaluated
  – F 2: 20% less than standard irrigation (8 minutes)
  – F 8: normal irrigation - 70% of ETo (10 minutes)
  – F 9: 120% more than normal irrigation (12 minutes)

8 min irrigation fairway 2
Dry area 61.2 ft  Wet area 56.8 ft

Precision management and white grubs
Soil moisture sampling with TDR 300 soil moisture meter and Trimble Ag GPS 132

White grubs in the southwest
Adult masked chafer  Larval masked chafer

Soil moisture determined in 95 areas that showed signs of grub damage

After testing for soil moisture, sampling for grubs occurred
Higher soil moistures favored the presence of chafer grubs

Role of irrigation distribution and soil moisture in chafer damage

1.6% chafer damage
Lack of irrigation uniformity is a given
Use maps and sensors to:
- Identify, illustrate, quantify complex problems
- Scout for chafers in high risk wet areas first
  - Irrigated by multiple heads
  - Low spots
  - Poorly drained spots
- Spot treat with more precision
- Track progress
- Identify and fix wet areas

Observe
- Look for management zones – wet spots, dry spots
- Look for repeated incidence of insect invasion – grubs for example
- Identify difficult to manage areas
- Traffic patterns
- When problems occur and where
- When and where there are no problems

GPS Mapping Data

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<th>Precip in/hr</th>
<th>Area sq ft</th>
<th>% Area</th>
<th>Damage sq ft</th>
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Document

- At a minimum use a bound notebook
  - Note the date
  - Note the location so that you can return to the area
  - Note your observations – too wet, turn down the heads on the left side of fairway 9 at the 120 yard marker.
  - Never depend upon your memory
- Any portable recording device will work but everyone should have a notebook

Map

- Draw a map of the area in a notebook
- Use an irrigation map or aerial photograph to take notes on
- Use GIS/GPS technology to make notes on an electronic map

Manage

- Use the smallest reasonable unit as a management zone
  - Instead of treating all fairways, treat individual fairways or only portions of a fairway
- Improve timing of activities
- Minimize human, natural, mechanical and chemical resources to provide optimum turf performance

Precision Management

- A step beyond Integrated Pest Management
- A step beyond Best Management Practices
- Precise management in space and time (spatial – temporal)

Torrey Pines Golf Course
Candice Combs, CGCS

Legend
- Bermudagrass Areas
- Greens
- Bunkers
- Fairways
- Cart paths
Del Mar Thoroughbred Club

Before 1 inch irrigation

Legend
- Bermudagrass Areas
- Greens
- Bunkers
- Fairways
- Cart paths

After 1 inch of irrigation
Cool Season Turf Stress
Warm Season Turf Stress
Tree maintenance
Renovation
Overseeding
Soil and water testing
Aeration
Heavy topdressing
Venting
Grooming
Vertical mow
Light topdressing
Traffic control
Monitor salinity
Leaching
Irrigation maintenance
Drainage improvement
Hand Watering
Aerial Photography
Nitrogen 0.2 lb 1000 sq ft
Potassium K2O 1 lb 1000 sq ft
gypsum 10 lbs/1000 sq ft 10 lbs 1000 sq ft
Mach 2 (I1,2,3,4,5)
Conserve (I3,4)
Merit (1) if needed
Banner Maxx (D1,2,3,4)
Heritage (D1,2,3)
Cleary’s 3336 (D1,3,4)
Eagle (D1,2,3,4)
Fore (D5)
Barricade (W1,2,3,4)
Lontrel (W5)
Prograss (W2)

The Management Plan
Site-specific climate, cultural practices & pest control strategies are integrated into a final plan

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