On-farm Response Strategies to Drought

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Response depends on:

- Water source (surface or well)
- Timing and amount of reduced water delivery
- Cropping mix that can be grown
- Irrigation systems used
- Soil depth and water holding capacity
Water Source Considerations

• Wells
  – Timing and amount of water supply is under farmer control within water right or other constraints
  – If total withdrawal is limited, farmer can still manage timing of reduced well flow

• Surface
  – Timing and amount depend on water delivery policies and system constraints – less flexibility than with wells
Timing of Crop ET and Critical Crop Stages for Magic Valley Conditions

- Winter Grain
- Spring Grain
- Dry Beans
- Potatoes
- Field Corn
- Sugar Beets
- Alfalfa

Tillering
Tillering
Boot - flower
Boot - flower
Flowering
Tuber set
Pollination
Germination, Emergence & Early Growth
Early growth
New fall seedings

Date
Timing and amount of delivery

• If limited supply can be delivered for full season at reduced rate
  – All crops can be grown but on limited area
  – Sprinkler systems can be modified to cover less area with reduced flow – then crop stress on reduced areas can still be minimized

• If limited supply must be delivered at nearly full flow until supply is gone (e.g. leaky canals)
  – Only shorter-season crops can be grown
  – Carefully schedule system turn-on (wait till water needed)
  – Fill deep soils early to minimize evaporation losses and store maximum water in crop root zone
Adjust cropping mix to fit water supply

30-yr Average Estimated Seasonal ET, Kimberly

Seasonal ET, gallons/acre

Alfalfa, Lawn, Sugar Beets, Pasture, Corn, Potatoes, Winter grain, Spring grain, Dry Beans

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Average 30 Year Calculated ET for Typical Magic Valley Crops

Agrimet Estimated Crop ET, in/d

- Alfalfa Mean
- Corn
- Russet Potatoes
- Spring Grain
- Lawn

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Irrigation system considerations

• Surface Irrigation: less water means more attention to set time and flow rates

• Sprinkler systems:
  – Set or set-move systems are usually designed to be able to “keep up” all season. With reduced water
    • Fix leaks (average 12% losses) and replace worn nozzles (average 13% over application)
    • Use shorter set times to avoid over-watering
    • Skip sets with lowest crop productivity
WL15 wheel line: 9/64 nozzle, 32 psi

2-month old R2000 windfighter
Impact sprinkler 7a, 50 psi, <2mph wind

CU=78%
Impact sprinkler 7a, 40 psi, <2mph wind

CU=61%
Impact sprinkler 7a, 30 psi, <2mph wind

CU=56%
Center pivot systems

• Usually designed to apply less than peak ET
• Application per revolution limited to prevent runoff
• Therefore, apply extra water before peak ET period
• When water delivery rate is reduced
  – If system is over 5 years old, replace sprinkler package (poor measured water application uniformity meant 65% of systems tested needed new sprinkler packages)
  – Shut off end gun and re-nozzle
  – Shut off end gun and outer span if necessary (outer span most prone to runoff)
  – Run system as slow as possible without runoff to minimize evaporation losses
  – Plant half to early crop and half to later crop / re-nozzle for 2nd crop
Use irrigation scheduling to best match water applied to crop need during the growing season

- Water budget with AgriMet
- Shovel or soil probe with soil feel and appearance method
- Soil sensors with in-field data loggers
- Soil sensors with data transmitted to web server and accessible from internet
Hansen AM 400 Data Logger and Watermark sensors

- Cost: about $375+$200 for wire and 6 sensors
- Records data from 6 sensors every 8 hours
- Single button display shows 5 weeks data for each sensor
- Weatherproof and can be used in the winter
- Memory stores entire season of data without downloading
- Can download at any time
- Shows change in moisture with time at selected depths
- Can be set up to show leaching events

Sensor source:
http://www.irrometer.com/sensors.html

Data logger source:
http://www.mkhansen.com/
Decagon ECH₂O Probe & Data Logger

- Capacitance probe (measures dielectric permittivity) of soil
- Output is volumetric water content
- Data logger also supports rain gage & temp sensors
- Manufactured by Decagon (Pullman, WA)

Cost of system with 4 soil moisture sensors, rain gage, radio transmitter (one set for each field): about $1300

Additional cost for receiver in pickup etc. and software (one set of this equipment serves all fields): about $770

Website: www.decagon.com/
Data from 1 or 2 probes with soil moisture measurements at 4, 8, 12, 18, 24 and 40” transmitted to JD website for user access from any web-connectable computer.

Approximate cost for components for one field:

Gateway logger / transmitter with first year installation and data plan: $$2900

1-m probe with capacitance-type sensors and 200 ft cable to connect to Gateway: $1900

Source: local John Deere dealer
Features include:

- Multiple sensors with flexible depth placement (at 10 cm increments)
- Monitoring from shallow depths (0 - 10 cm) to deep installations (> 40 metres)
- Length of probe customised to suit the application (probe length adjustable in the field)
- Up to 16 sensors on one probe (moisture or moisture/salinity)
- In-built probe orientation and depth settings to enhance sensor repeatability
- Full serviceability
- Flexible connectivity for wide range of data retrieval options

**Probe Sealing**

The bottom of the access tube is typically sealed using a double-ringed expandable rubber bung, providing 2 sealing points and preventing underground moisture from entering the tube. A slurry cap is also available.

The top of the access tube is sealed with 2 different top cap designs, depending on application.

**EnviroSCAN Screw Cap**

- Top cap protrudes above the soil surface
- Easy to find and readily accessible
- Tightly sealed with a rubber O-ring
- Simply unscrews, giving easy access to the probe for servicing

**EnviroSCAN Flat Cap**

- Allows for the probe to sit flush with the ground surface
- Water-tight, 3 point sealing design
- Provides ready access to the probe for servicing
- Avoids potentially costly damage from machinery
Analyze your data through graphical display

Graphical display

08-10-2012 (1:15 PM) to 09-10-2012 (1:15 PM) - America/Los_Angeles
Sensors: All, Use Interpolation: Yes, Show Zeros: No

Soil Moisture Level (inches)

Graphical display
Summary: on-farm irrigation responses

• Adjust cropping mix to match timing and rate of water delivery

• Perform needed irrigation system maintenance
  – Set & set-move systems: fix leaks, replace worn nozzles, replace worn or malfunctioning sprinkler heads
  – Center pivot /linear: replace pressure regulators & sprinkler packages older than 4-5 years

• Use an irrigation scheduling method to match water applied to crop need throughout the season
The End -- Questions?