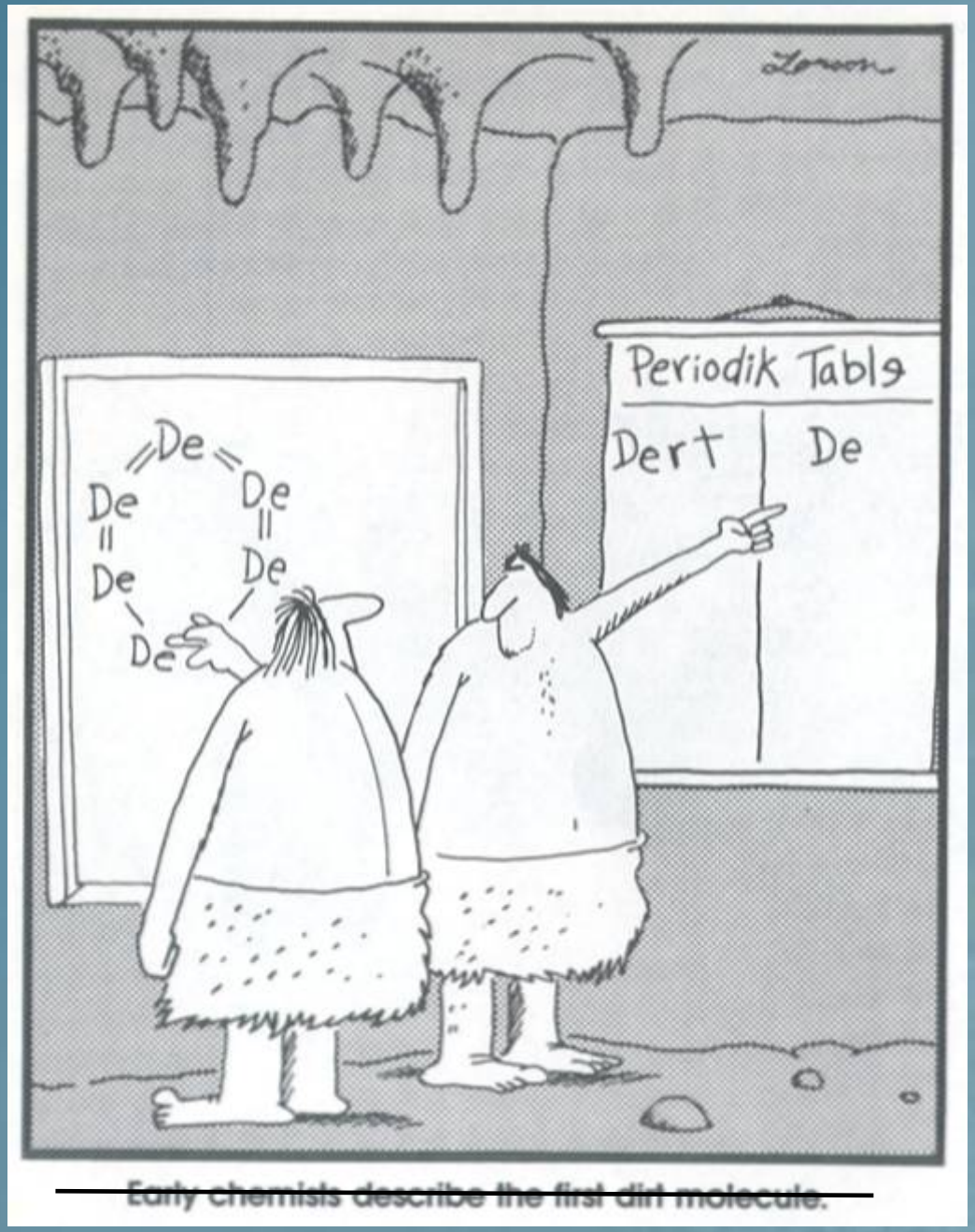

Early AES students describe the first dirt molecule

Management Zones

Topic 9

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History

- Before large machinery, farmers worked the land behind a mule and harvested by hand
  - they knew land intimately
  - understood yield potential of areas within fields
  - applied fertilizers (manures) variably

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Recent Past

- Advent of large farm machinery resulted in uniform management of large fields
  - uniform application of inexpensive fertilizers
  - evaluating yield potential of entire fields rather than areas within

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Future…

- Precision Ag allows us to
  - make decisions at the scale used by our ancestors
  - continue to farm large acreages with big equipment

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Future…

- Precision Ag fundamentally requires matching inputs to need
  - If a part of a field requires more fertilizer, apply more
  - If a part of a field matures sooner, harvest it sooner
- Common sense ideas, but how do you implement them on the farm?

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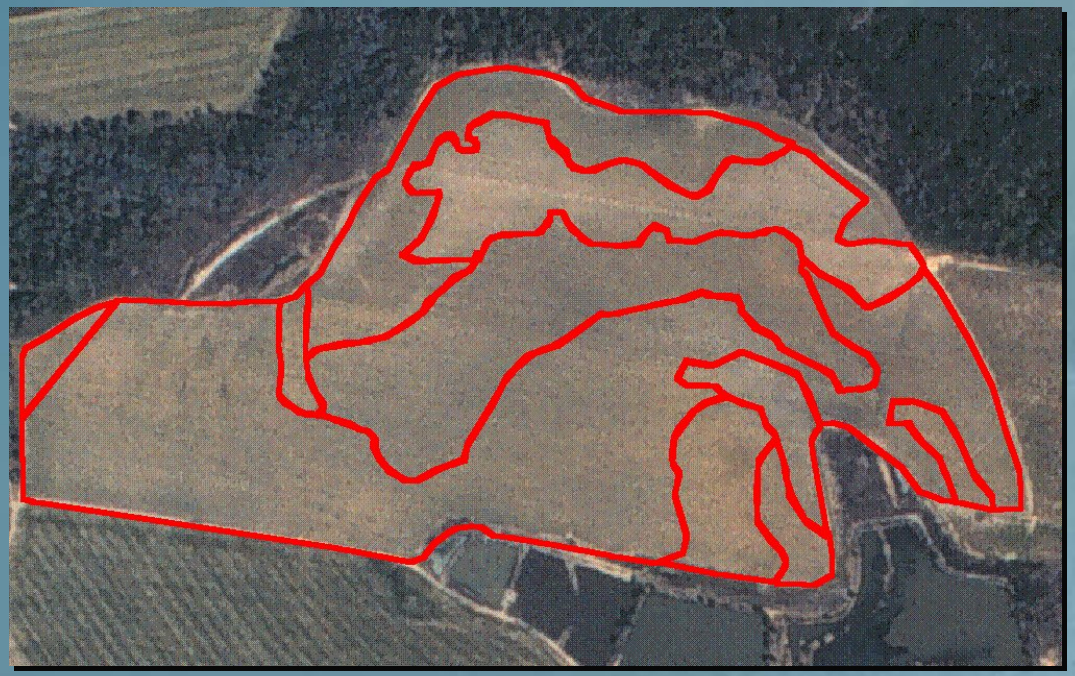
How to Implement Precision Ag?

- Implementation best achieved through Management Zones



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What are Management Zones?

- Regions or areas of field which have been differentiated from the rest of the field for the purpose of receiving individual management attention

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History of Management Zones

- Within the Precision Ag community, there has been some reluctance to accept Management Zones (MZs)
  - "not a high-tech solution"
  - not cookbook – are not created using formulas or software and thus labeled unscientific
  - requires intellectual horsepower

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Management Zones & Technology

- Management Zones have been, and continue to be, used on farms that do not use GPS, GIS, and other Precision Ag technologies
- Using Precision Ag technologies makes implementing Management Zones easier

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Creating Management Zones

- No set rules for creating MZs
- Management Zones are created by evaluating all the information that is available for a field
  - physical properties of the field
  - management abilities of the farmer
  - potential return of implementing MZs

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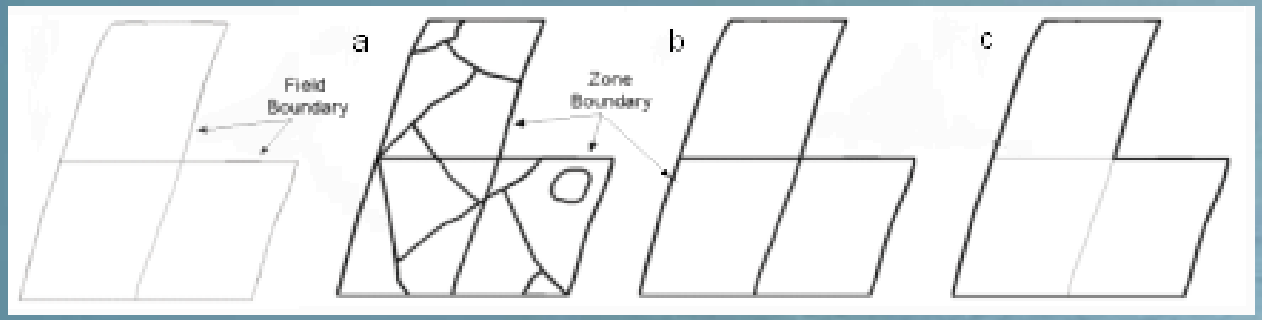
Number of Management Zones

- Number within a field will vary from zero to many
- Number is a function of
  - field size
  - field variability
  - ability of farmer to vary management



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Size of Management Zones

- Generally, minimum size is determined by the ability of the farmer to differentially manage within a field
- This is usually a function of equipment size
  - example – if swath of fertilizer spreader is 50ft
- Maximum size is set by field boundaries

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Shape of Management Zones

- If GPS is used to guide implements, shape is not limited theoretically
- Practically, shape should match application abilities
  - overly narrow zones perpendicular to the line of travel result in zone within which equipment does not have the time to make changes
- Shape of MZs should be practical

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Management Zone Boundaries

- Changes of field physical properties occur gradually
- Similarly, changes in application rates require transition time
  - equipment response times are not instantaneous
  - frequently require several seconds to switch from one rate to the next

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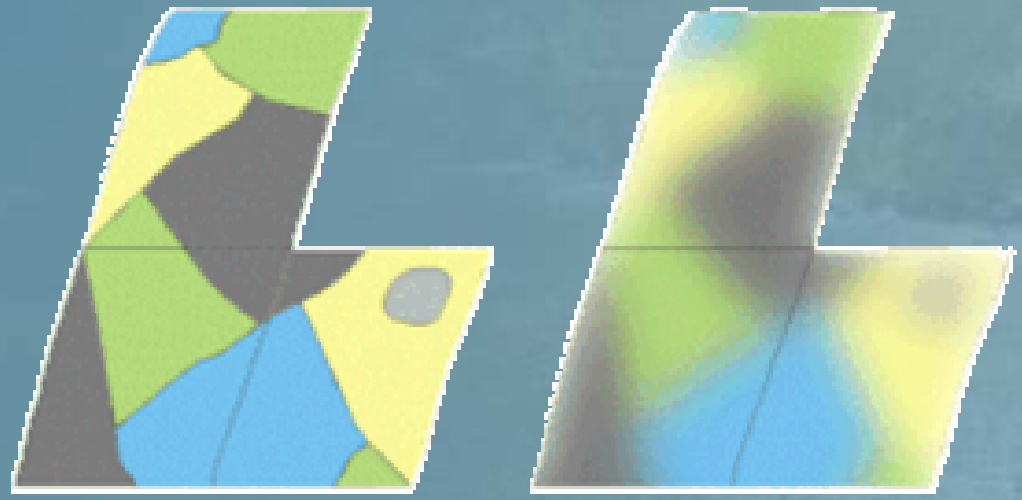
Management Zone Boundaries

- In reality, boundaries between management zones are transitional
- In practice, it is easier to give MZs distinct boundaries



distinct transitional

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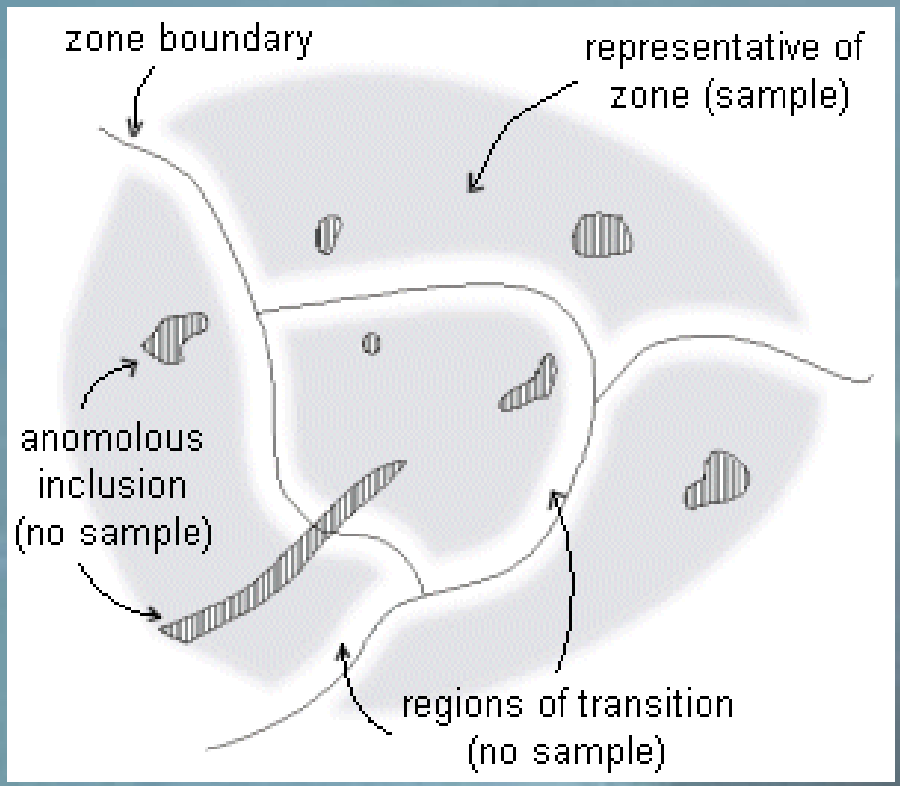
Example of Management Zones

- Allow for transitional boundaries
- Small areas which are impractical as MZs are identified but are not sampled for field management



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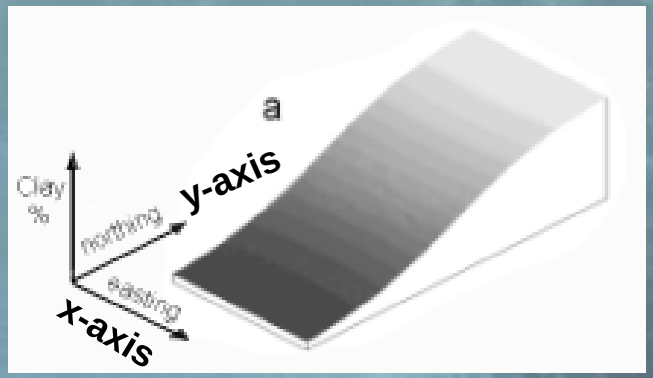
Management Zones & Field Variability

- Management Zones are useful only if there is variability
- There are two kinds of field variability
- z-axis variability
  - the magnitude of the difference between regions with respect to the value of a given attribute



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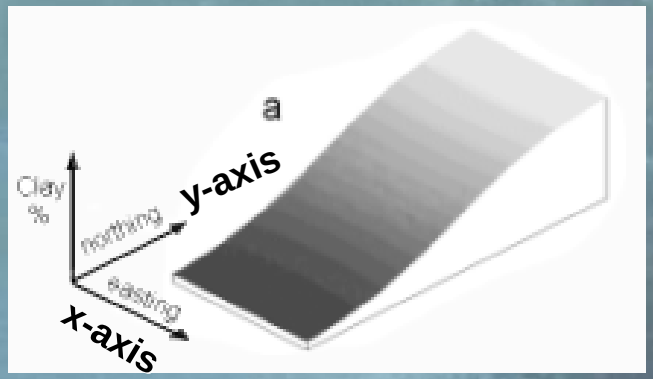
Management Zones & Field Variability

- z-axis variability example
  - clay content of a field varies from 2% to 40%
  - variability only in one direction
  - this is 2-dimensional variability (z and y axes)
- z-axis variability means variability is easily understood and measured
  - easy to delineate Management Zones



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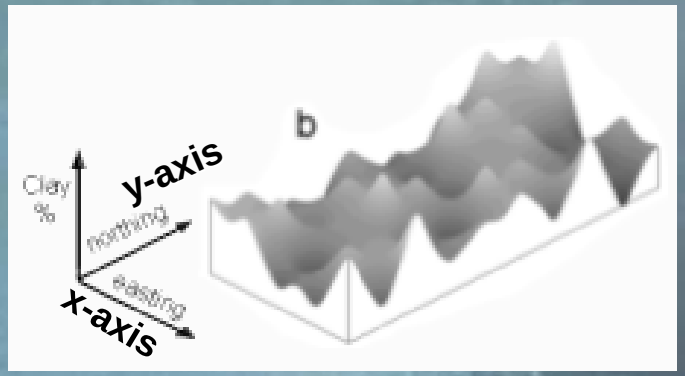
Management Zones & Field Variability

- **xy-axis variability**
  - rate at which z-axis variability occurs spatially
  - variability in two directions
  - this is 3-dimensional variability (z and x & y axes)
  - clay content may vary between 2 and 40% several times within a short distance in both the x and y directions

- **xy-axis variability means variability is more complex and less easily measured**
  - may be difficult to delineate Management Zones



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Management Zones & Field Variability

- A field with high xy variability may not have high z variability
- A field with high z variability may not have high xy variability

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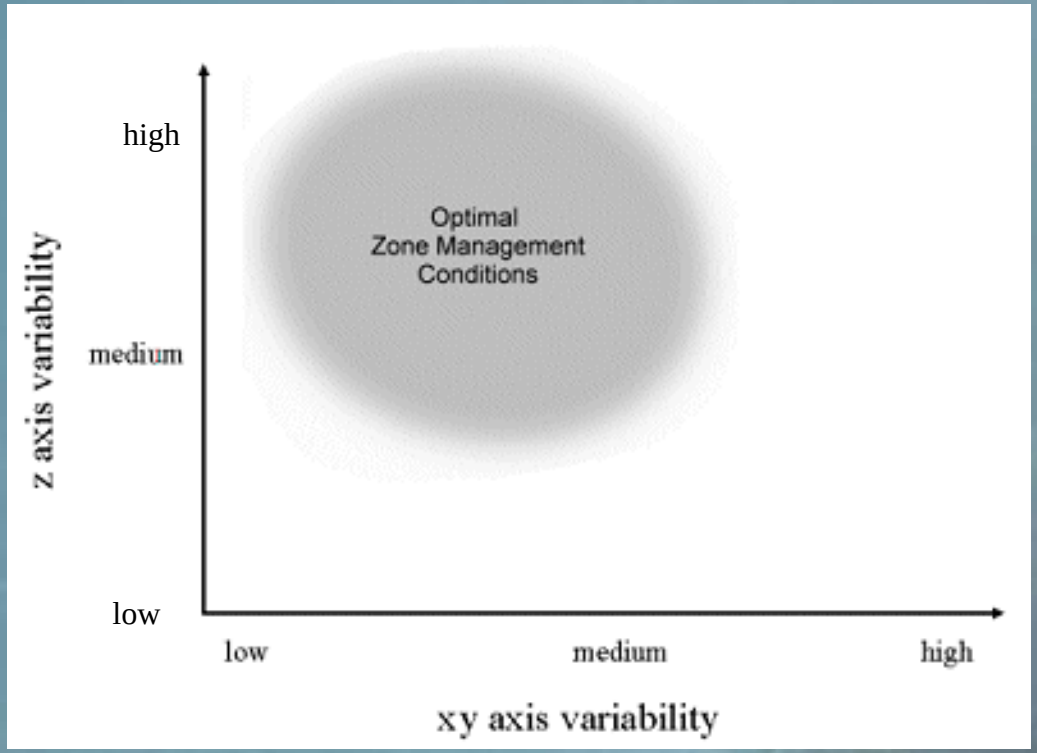
Management Zones & Field Variability

- **Optimal Zone Management conditions**
  - moderate to high amount of z variability
  - low to moderate amount of xy variability



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Developing Management Zones

- No standard methods for delineating Management Zones
- Tools used should match resources and skills available
- Quality of delineated zones will be a function of:
  - tools, resources, and skills used
  - nature of the field

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Developing Management Zones

- Methods used for one field may not work for other fields
- If tools, resources, and information are not available
  - do not delineate Management Zones
- If field is too complex
  - do not delineate Management Zones

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Developing Management Zones

- **Resources and information useful for delineating Management Zones**
  - bare soil aerial images (wet, dry)
  - field boundaries
  - topographic maps
  - soil surveys (marginal use for small fields)
  - yield maps
  - vegetation imagery
  - vegetation indices

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Developing Management Zones

- More resources and information useful for delineating Management Zones
  - soil test results
  - minimum zone size estimation (equipment limitations)
  - location of field anomalies
  - pest reports (maps, scouting)
  - tile drain locations

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Developing Management Zones

- Even more resources and information useful for delineating MZs
  - management history information
    - position of old roads, houses
    - maps of past earthmoving operations
    - fertilization records (conventional and variable rate)
    - cropping records
    - irrigation coverage
    - field divisions
    - location of old wetlands
    - eroded areas

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Developing Management Zones

- Knowledge helpful in creating Management Zones
  - agronomy
  - farm management and economics
  - field history
  - equipment capabilities and limitations

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A Plan for Creating Management Zones

- Create a field template
  - field boundary
  - georeferenced bare soil aerial image is best
- Use as much of the information discussed earlier as you possibly can
- Start by defining areas that most obviously will benefit from differential management

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A Plan for Creating Management Zones

- Establish additional meaningful zones making sure this process is driven by available information
- Outline the Management Zones on the aerial image or field boundary
- Establish appropriate yield goals for each zone
- Monitor the performance of established MZs over time and attempt to understand the dynamics of each
- Fine tune the system as more information becomes available

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