Drainage water management effect on soil moisture, drain flow, and overland flow

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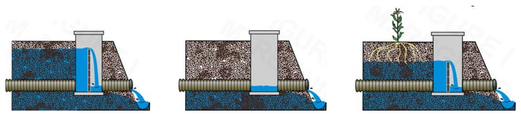
What is Drainage Water Management?



DWM system installed in field

Drainage water management allows water to be held back in the field, reducing nitrate load in drainage ditches and granting farmers control over water levels in the field during planting and growth.

Objectives

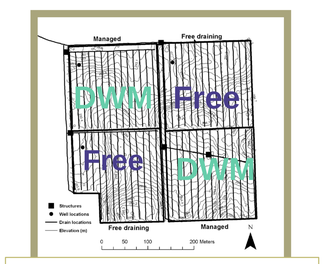
Our research is determining:

1. Whether the use of drainage water management reduce the occurrence of soils in our field drying out to levels that put stress on crops.
2. How drainage water management impacts total drainage volumes, peak flow rates, the time it takes to reach peak flow, and storage of water on a field during a rainstorm

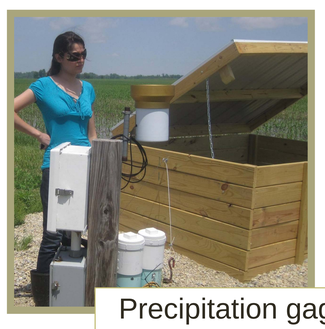
Collecting Field Data

Soil moisture sensors log data every 5 minutes at 5 depths at each site

Flowmeters take measurements every 15 minutes



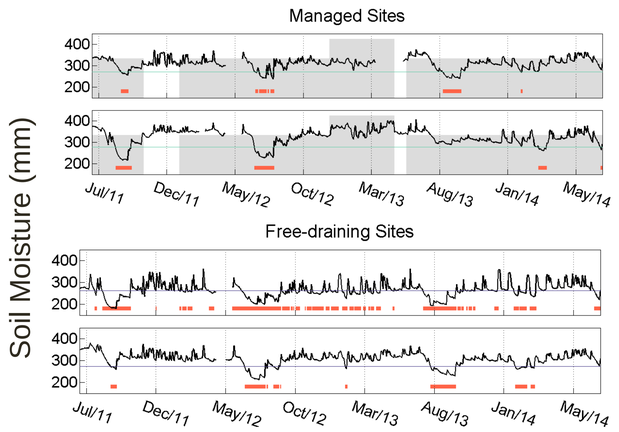
Two sites have Drainage Water Management installed.



Precipitation gage and data logger with modem

Does drainage water management retain soil moisture?

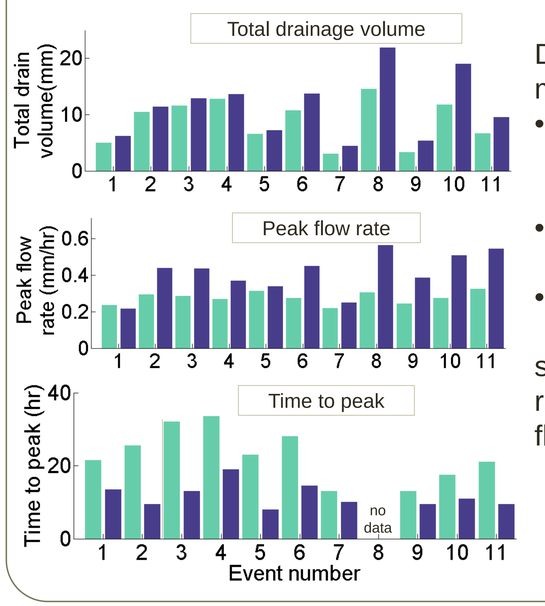
We determined the cumulative time during which soil moisture was below 60% of saturation during the growing seasons, May to October from 2011 to 2014.



Hours of Deficit
87
80
361
128

Does drainage water management reduce drain flow contribution to flooding?

In 11 drainage events in 2012 and 2013, we compared drainage from managed and free-draining sites.



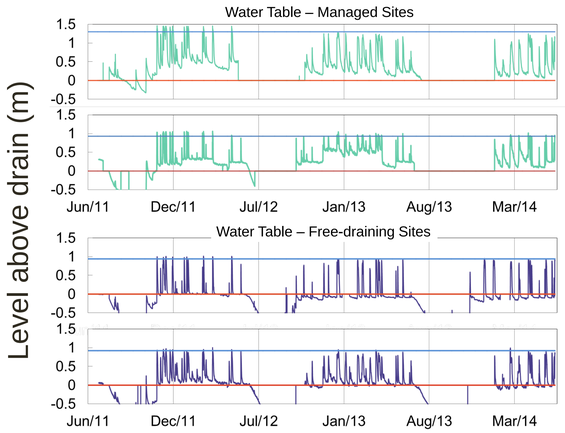
Drainage water management:

- reduced total drainage volume by 6-38%,
- reduced peak drain flow by 16-29%,
- delayed peak flow by 0-46%,

suggesting that it reduces downstream flooding potential.

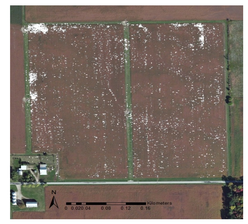
What about overland flow?

A reduction in flow through subsurface drainage could indicate an increase in overland flow. When water table measurements show water above the surface, water may be flowing over the ground; on the other hand, it may be stored in depressions.



Hours Above Surface
880
601
180
101

LiDAR elevation data showed 197 m^3 (1.2 mm) of depression storage in the field, indicating that water could be stored and infiltrated. White areas show depressions.



Findings & Conclusions

- Managed quadrants showed fewer hours of soil moisture deficit than free-draining sites for the period studied, suggesting that drainage water management retained soil moisture that could be helpful for crop growth.
- Time to peak, total drainage volumes, and flow rates through tile drains were all found to be reduced during rain storms in our managed field sites.
- The water “missing” from managed drains in these events may be leaving the field as runoff, or it may be stored on the field as soil moisture or ponding.

Acknowledgments

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