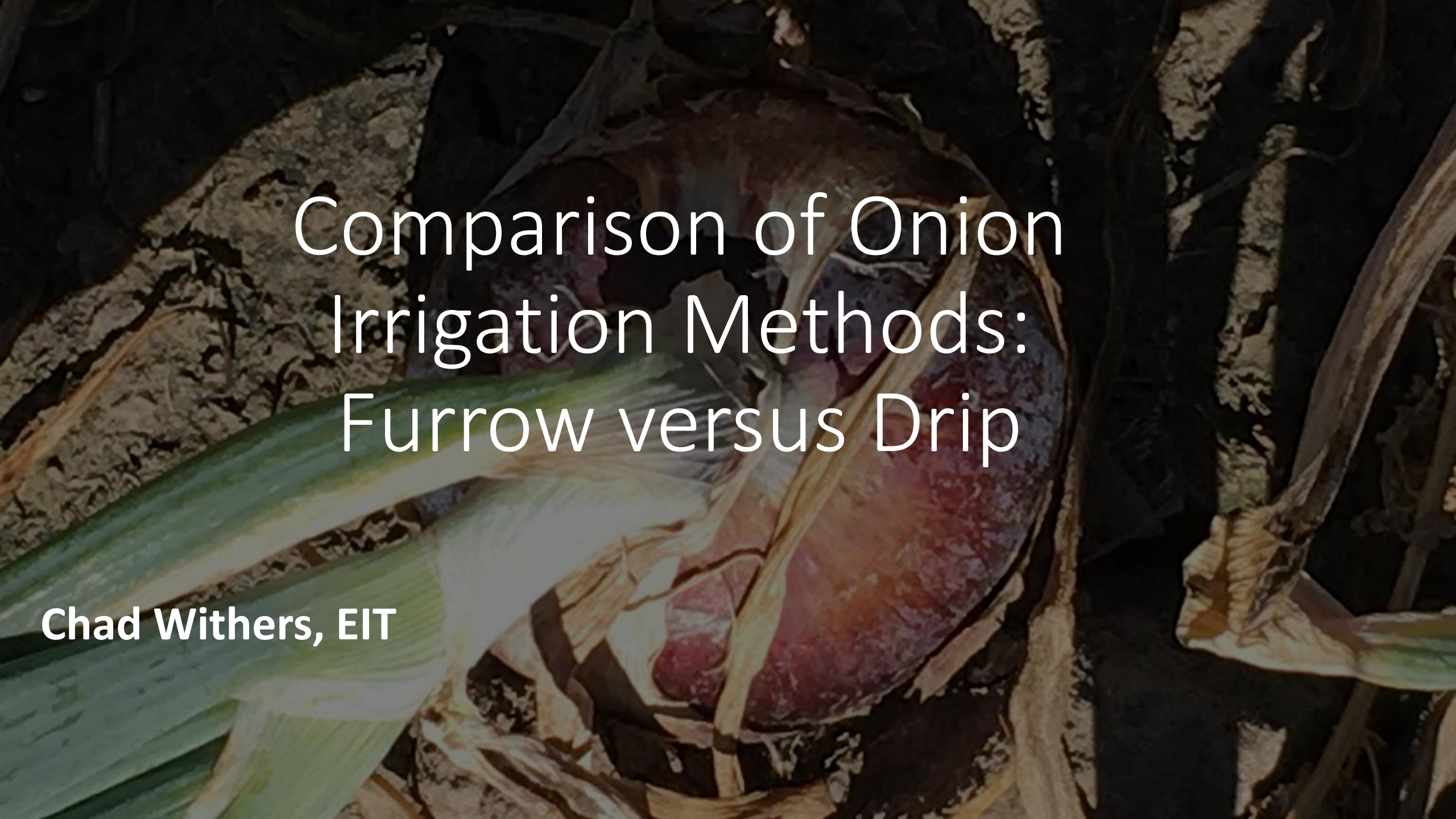
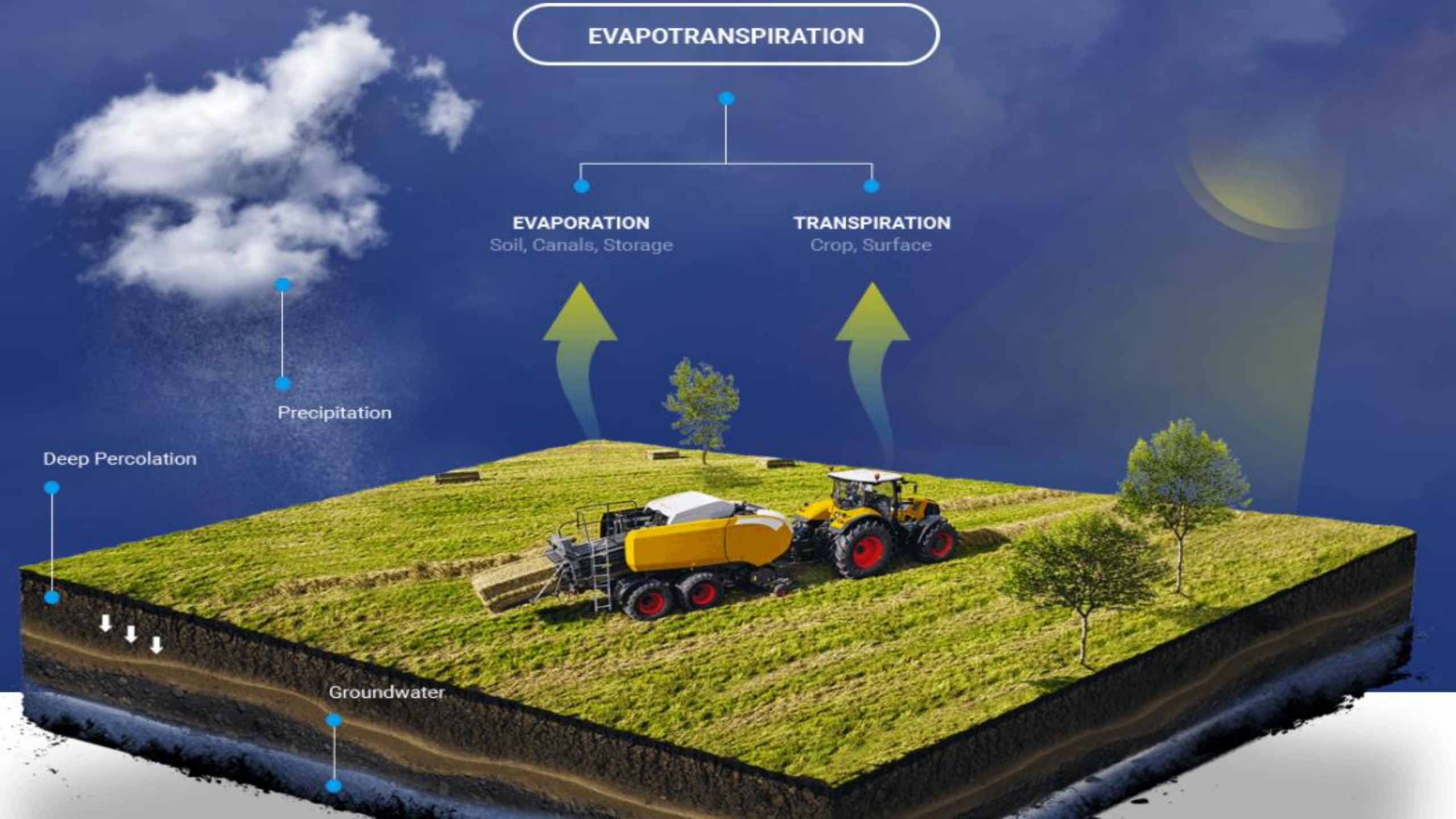


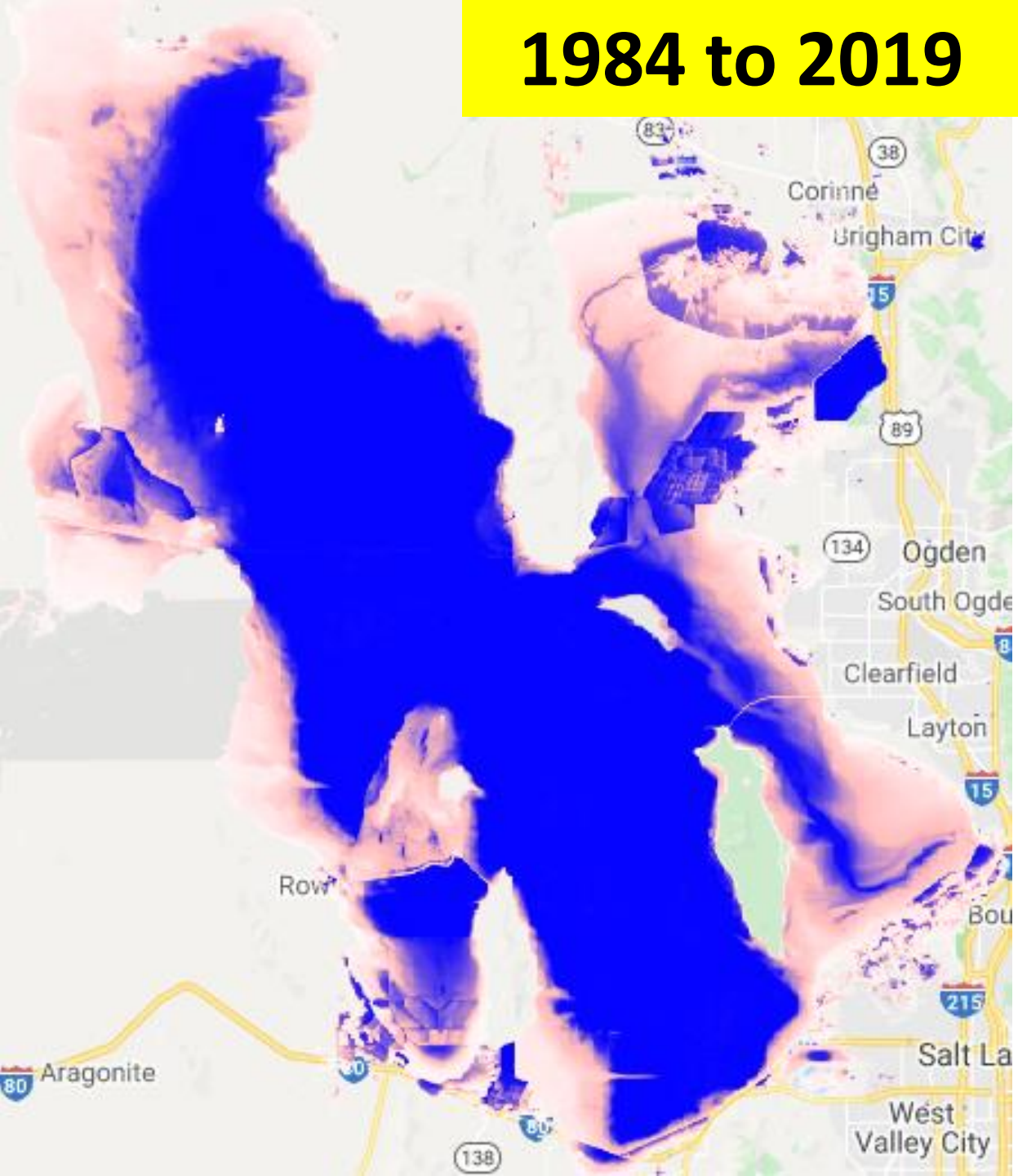
Comparison of Onion Irrigation Methods: Furrow versus Drip

Chad Withers, EIT

Furrow Irrigation

Drip Irrigation


EVAPOTRANSPIRATION
EVAPORATION
Soil, Canals, Storage
TRANSPIRATION
Crop, Surface
Precipitation
Deep Percolation
Groundwater



Warmer climate

+

Less snow pack

+

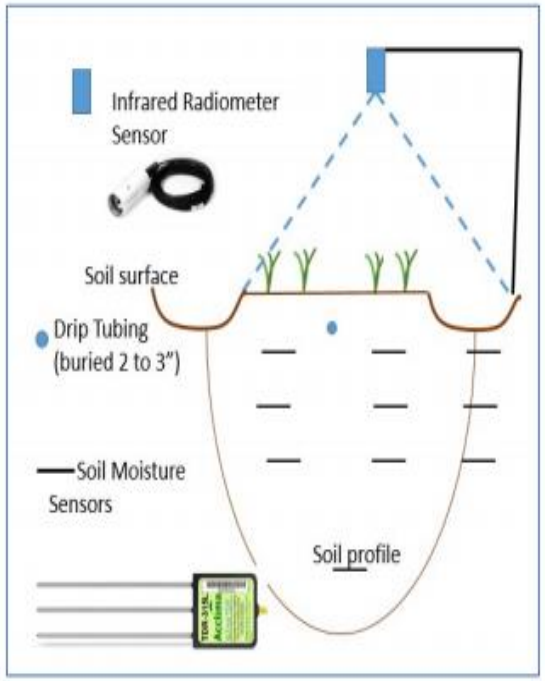
Municipal growth

+ or -

agricultural consumptive use

air quality, $57 M brine shrimp industry, bird habitat, the Lake effect which helps snowpack, etc.

- 2019: 1 drip field and 1 furrow field
- 2020: 2 drip fields and 2 furrow fields
- 3 stations per field
- 10 soil sensors per station



Soil Sensor Locations (West Weber)

Section Widths	onion Bed 11.5"	onion Bed 11.5"	furrow 16"
7"	1	2	3
9"	4	5	6
13"	7	8	9
14"	10		

* Not to scale




BRDE101
BRDM102
BRDW103
5200-W-Rd


Flow Sensor
BRFN201
BRFM202
BRFS203
N-4600-W


Bigfoot 104
Bigfoot 212
103
102
101
Bigfoot 251
Bigfoot 105
S-4300-W-St
© 2020 Google


Bigfoot 21
Bigfoot 211/Gateway
WW1
WW101/242
WW102/105
WW103/252


WW203/251
WW201/104
WW202/221
Gateway ww2
Flow M

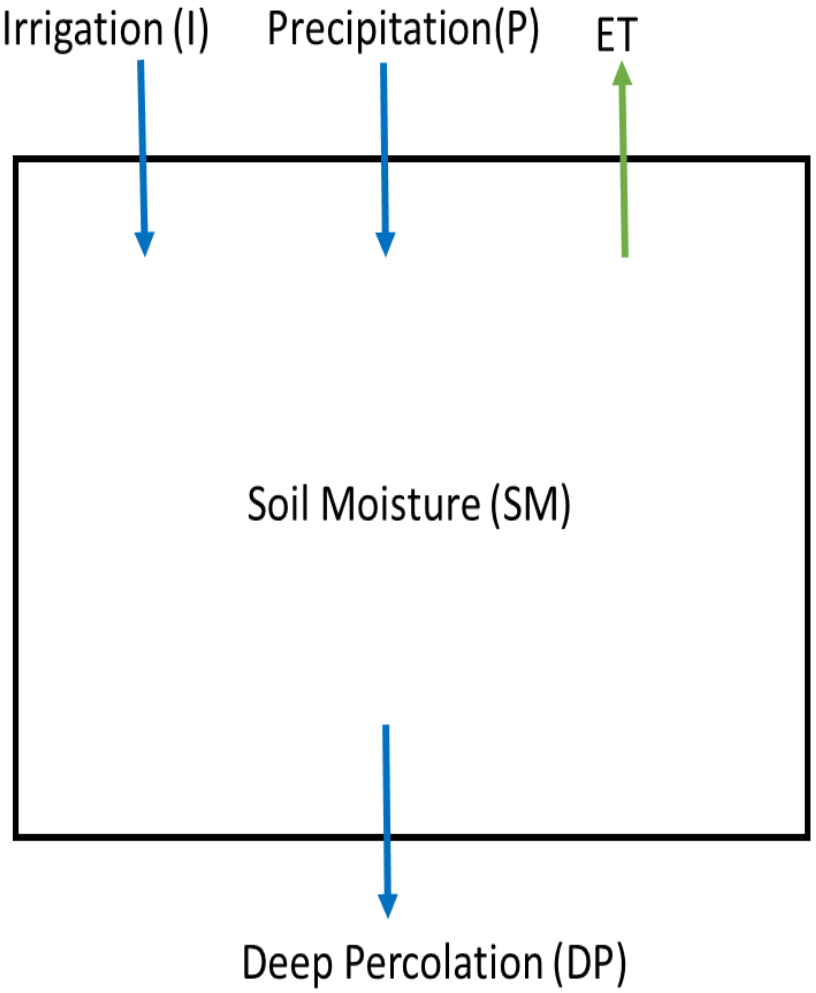

203
202
201
Flow Meter

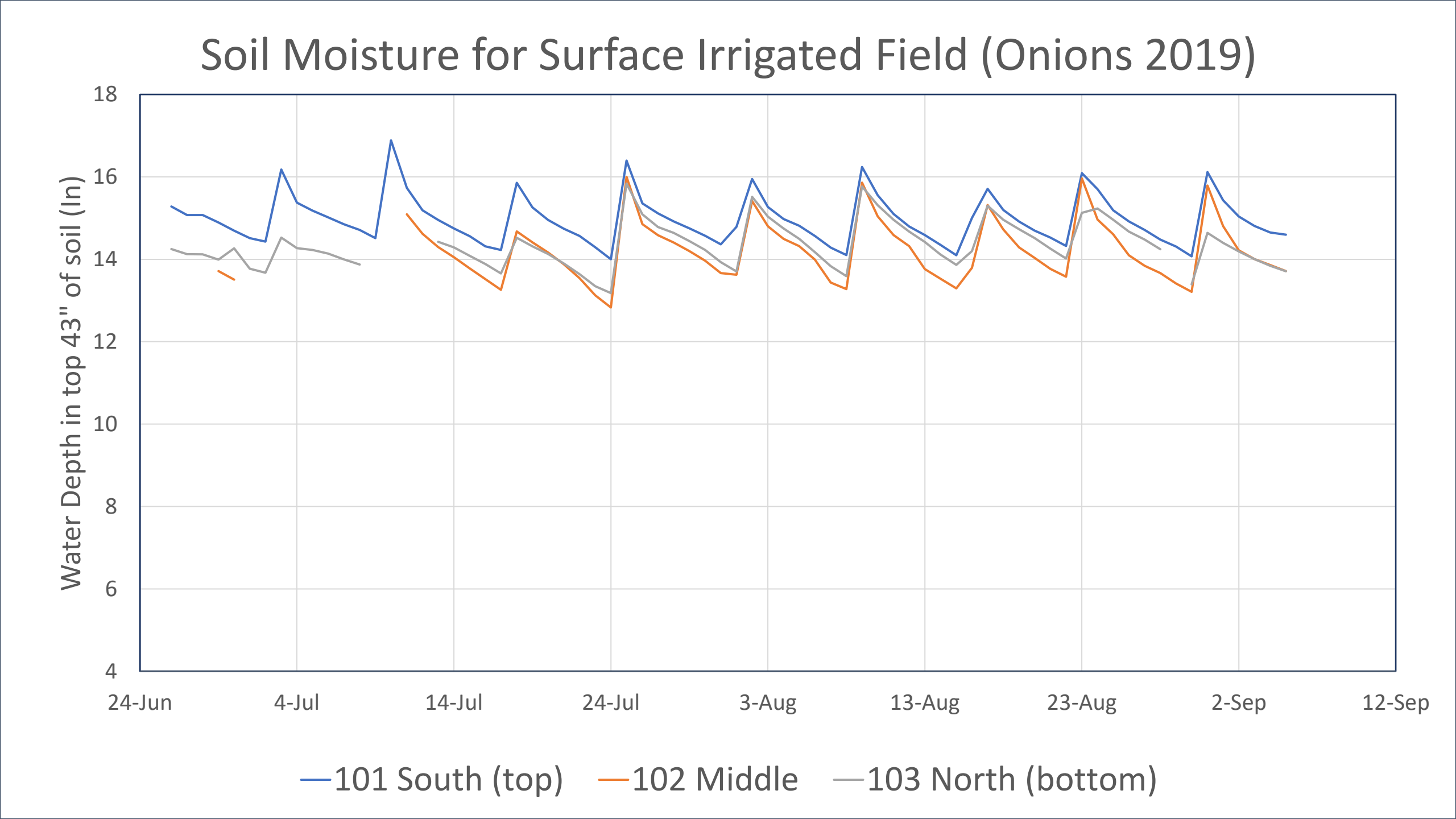
Onion Bulb Diameter (inches)

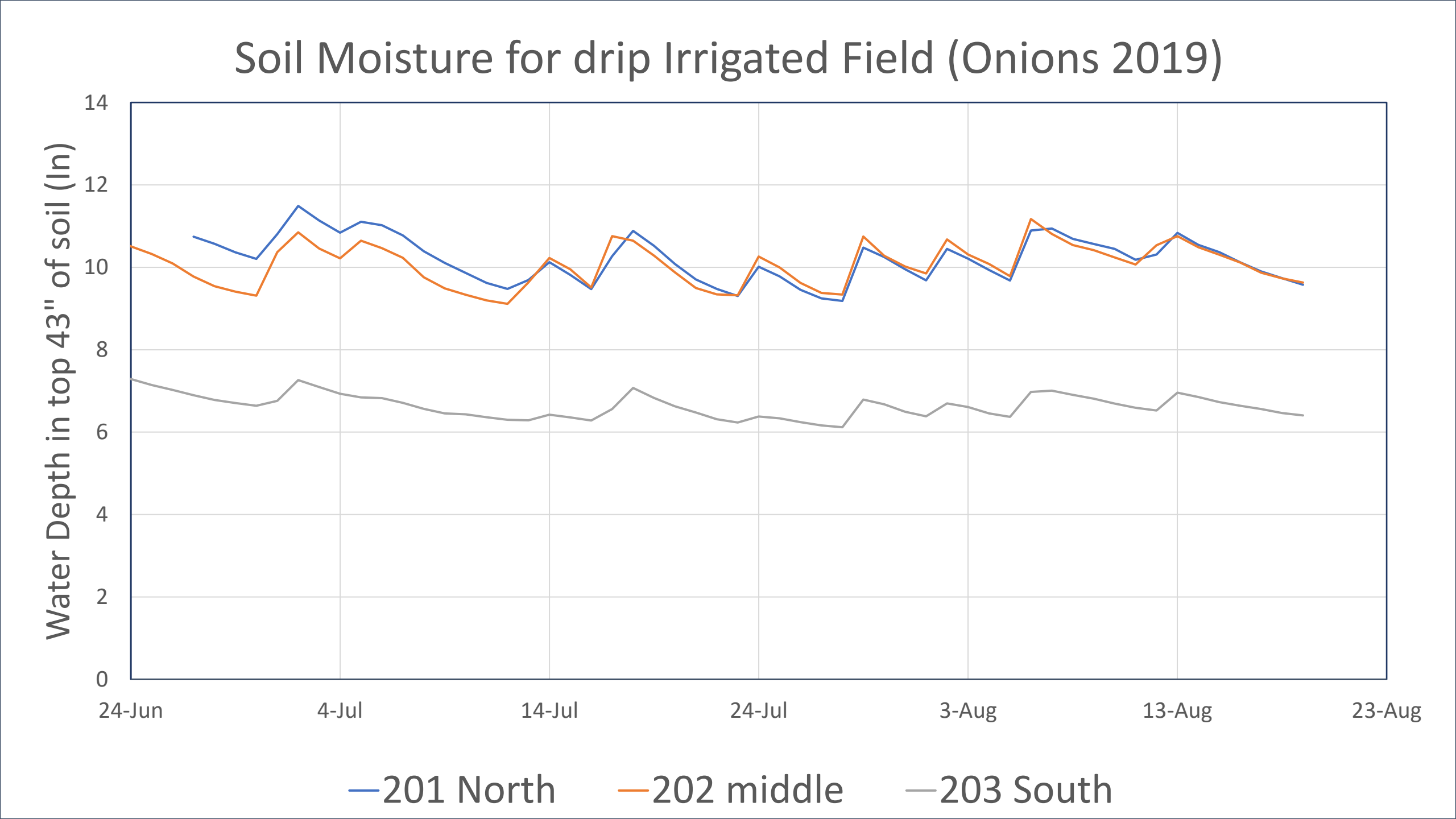
te	Rep	<2.25 ,<2.5 number	<2.25 ,<2.5 wgt	3 ,>2.5 number	3 ,>2.5 wgt	3.5 ,>3 number	3.5 ,>3 wgt	4 ,>3.5 number	4 ,>3.5 wgt	4+ numbe	4+ wgt
ast	1	6	2.9	33	14.1	21	13.2	2	3.3	0	0
	2	9	3.5	18	8.9	24	16.5	6	7.3	0	0
	3	5	2.9	16	8.1	38	23.8	3	4.4	0	0
	4										
ddle	1	2	2.3	15	8.3	32	22.4	12	11.5	0	0
	2	2	2.2	24	12.0	38	25.1	6	6.8	0	0
	3	0	0	4	3.2	55	34.8	8	8.2	0	0
	4										
t	1	1	2.0	2	2.6	33	23.3	25	24.4	0	0
	2	0	0	12	7.3	36	25.0	20	19.1	6	0
	3	0	0	5	2.5	41	32.0	14	14.1	0	6
	4										

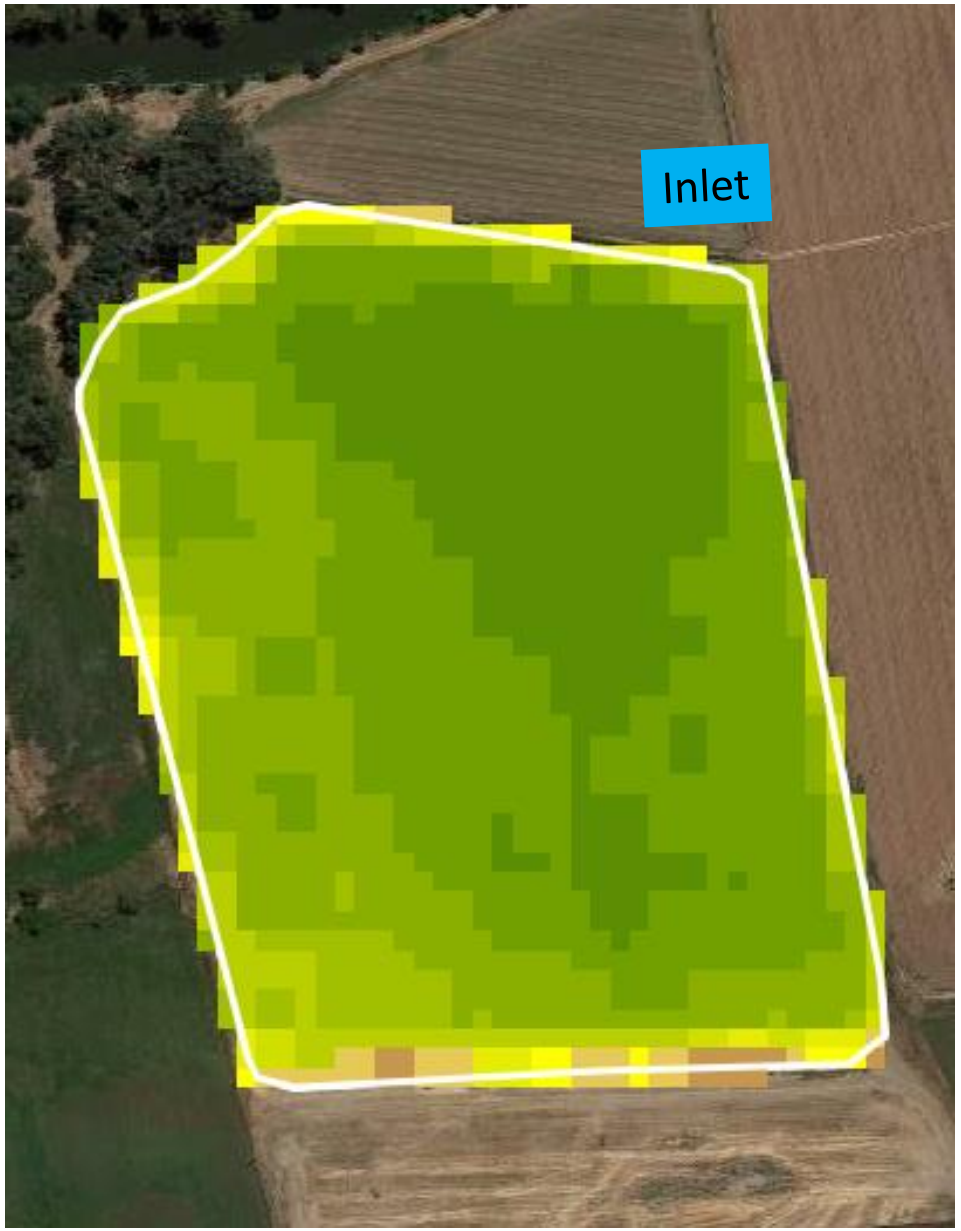
$$ET = SM_{beg} - Sm_{end} + I + P - DP$$

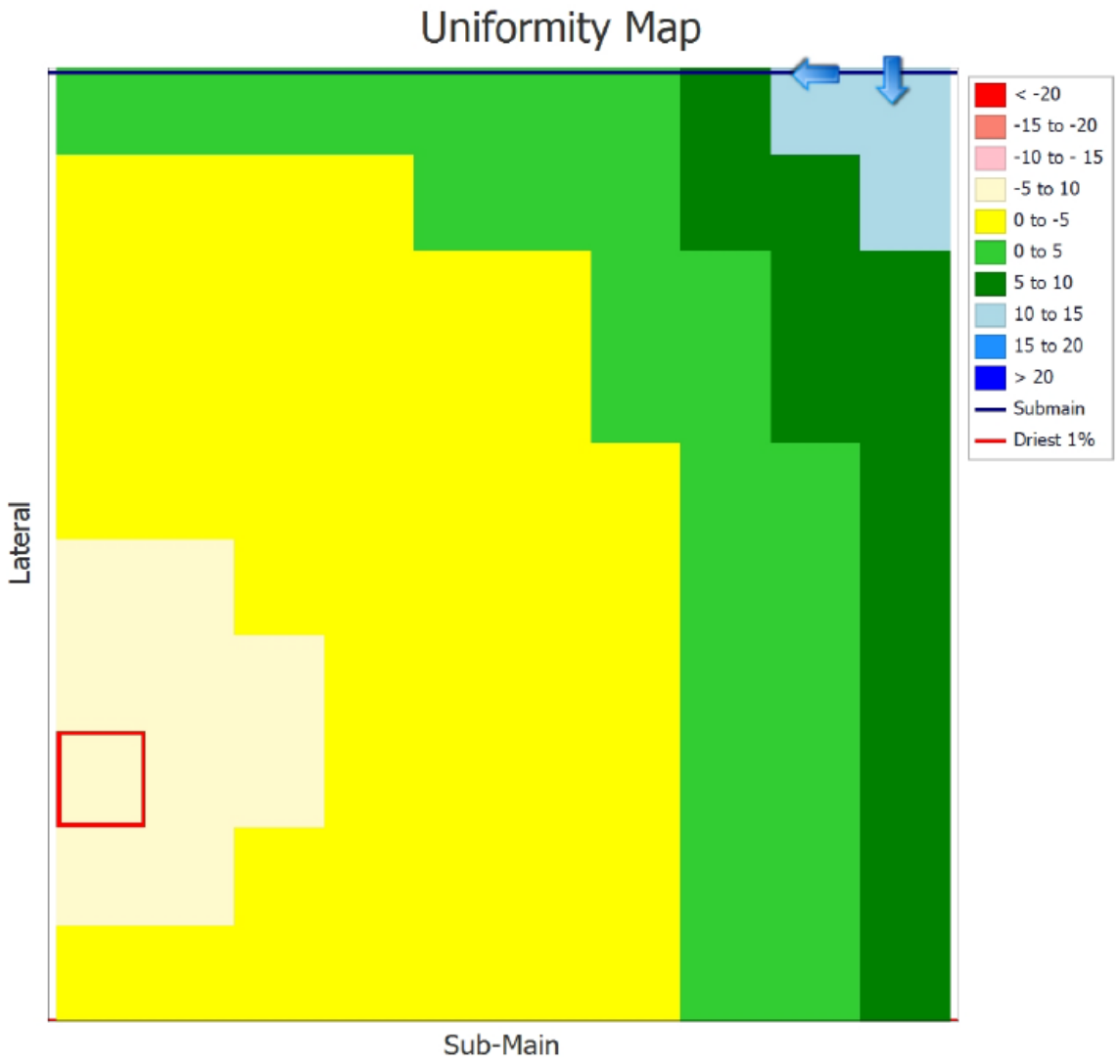
$$ET_{est} = SM_{beg} - Sm_{end}$$




Soil Moisture for Surface Irrigated Field (Onions 2019)
Water Depth in top 43" of soil (In)
18
16
14
12
10
8
6
4
24-Jun
4-Jul
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
2-Sep
12-Sep
101 South (top)
102 Middle
103 North (bottom)

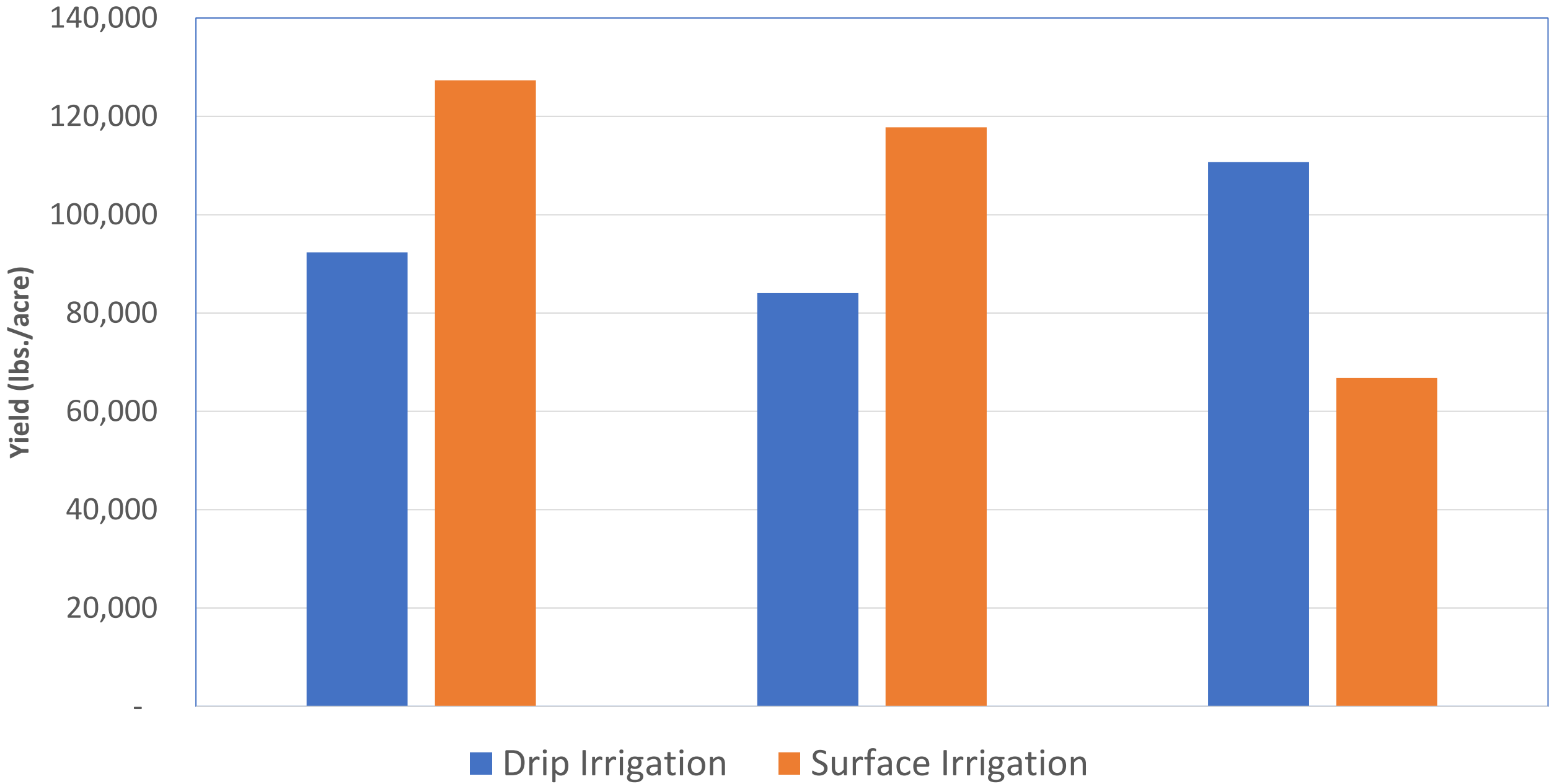

Soil Moisture for drip Irrigated Field (Onions 2019)
Water Depth in top 43" of soil (In)
14
12
10
8
6
4
2
0
24-Jun
4-Jul
14-Jul
24-Jul
3-Aug
13-Aug
23-Aug
201 North
202 middle
203 South





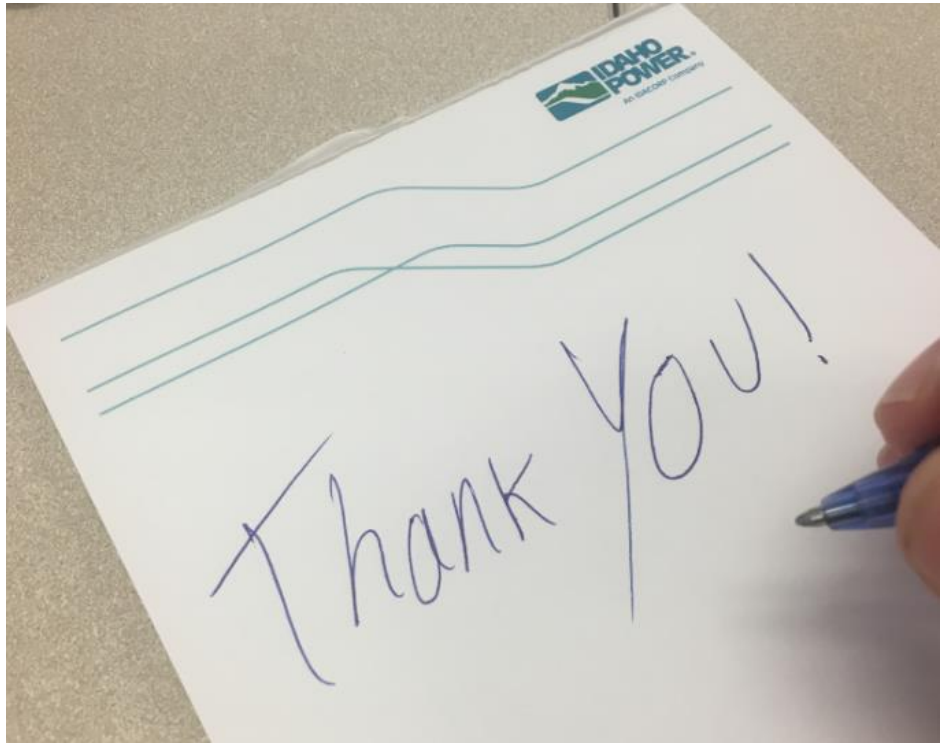
7/8” tape Emission Uniformity of 91%

Average Onion Yields Paired by Year and Location

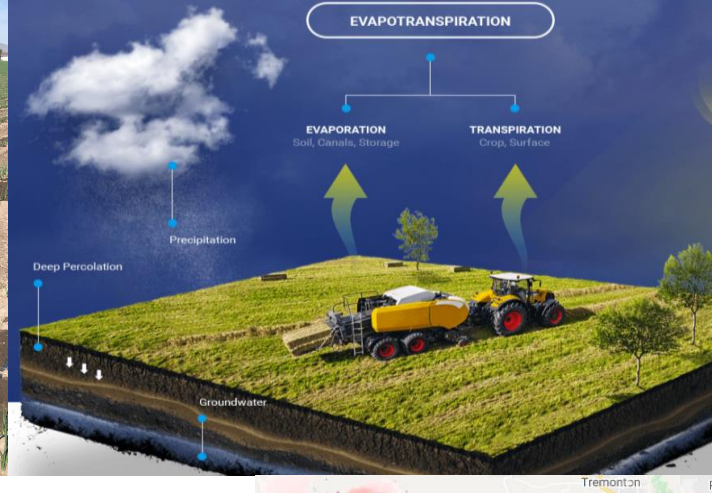


Conclusions

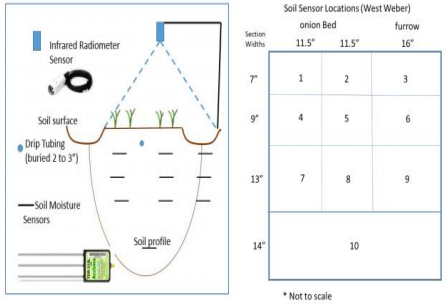
- Drip irrigation gets more crop per drop, but underirrigation can easily happen and cause lower yields
- Poor drip design causes reduced uniformity, which greatly reduces yield
- Drip irrigation is better at providing good establishment, which is critical for good yield
- Surface irrigation achieved great uniformity, but applied 2 to 3 times the amount of water

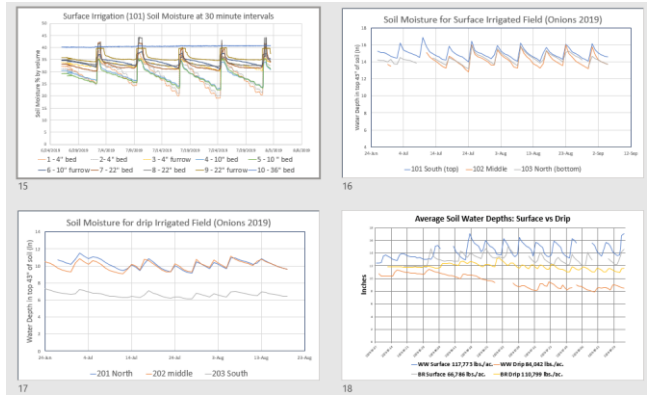


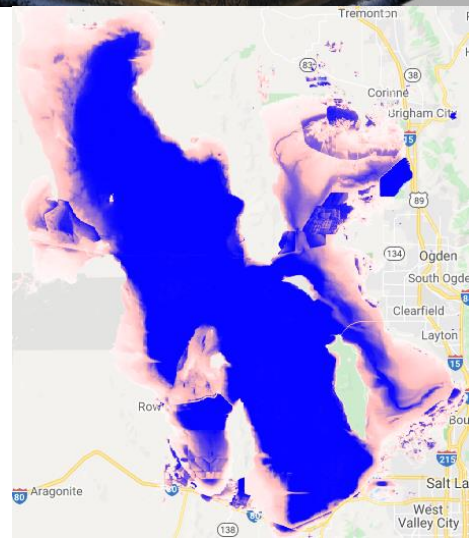
- L. Niel Allen, Ph.D., PE
- Alfonso Torres-Rua, Ph.D.
- Andy Keller, Ph.D., PE
- Collin Pace, EIT (undergraduate student)
- Joshua Drake (undergraduate student)
- Stephen Sanders (undergraduate student)
- Josh Hanks of Intermountain Environmental, Inc.
- Campbell Scientific, Inc.
- Ron Gibson (producer - cooperator)
- Kenny McFarland (producer - cooperator)
- Riggin Holmgren (producer - cooperator)
- Timothy Hawkes of the Utah State House
- Utah State Legislature for passage of H.B. 0381



Questions or comments?







$$ET = SM_{beg} - Sm_{end} + I + P - DP$$

$$ET_{est} = SM_{beg} - Sm_{end}$$