Introducing iCrop a web based decision support tool for optimizing water and nitrogen management

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iCrop

- **I**ntegrated **C**rop water and nitrogen management decision support tool.

- Useful for optimizing **strategic** (preseason) and **tactical** (in season) management decisions.

- Examples of potential applications:
    1. Land-water allocation
    2. Hybrid selection and seeding rate
    3. When to initiate irrigation
    4. When to terminate irrigation
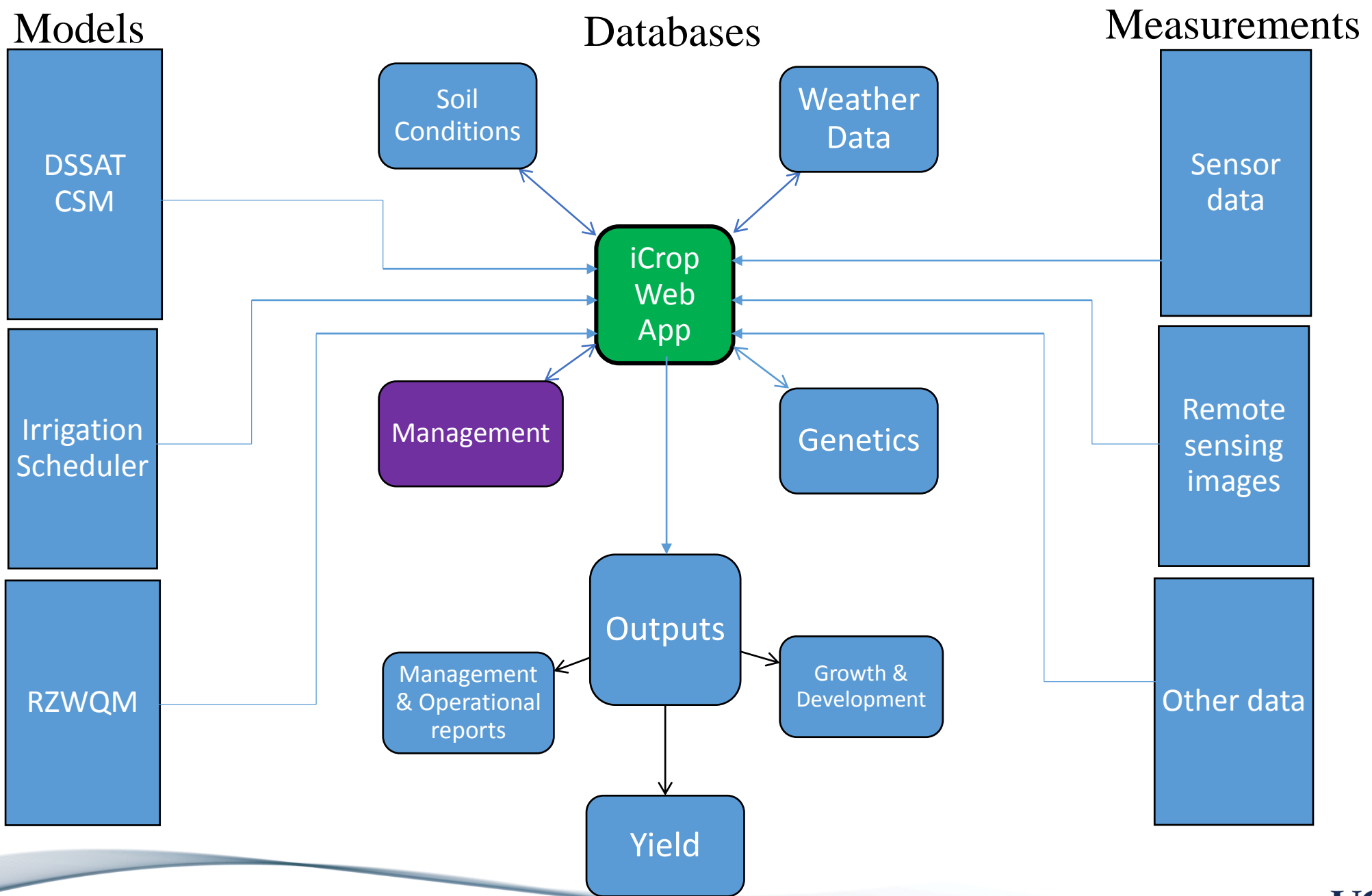   5. Effect of splitting nitrogen applications
    6. etc.

UC**DAVIS**

iCrop Conceptual framework
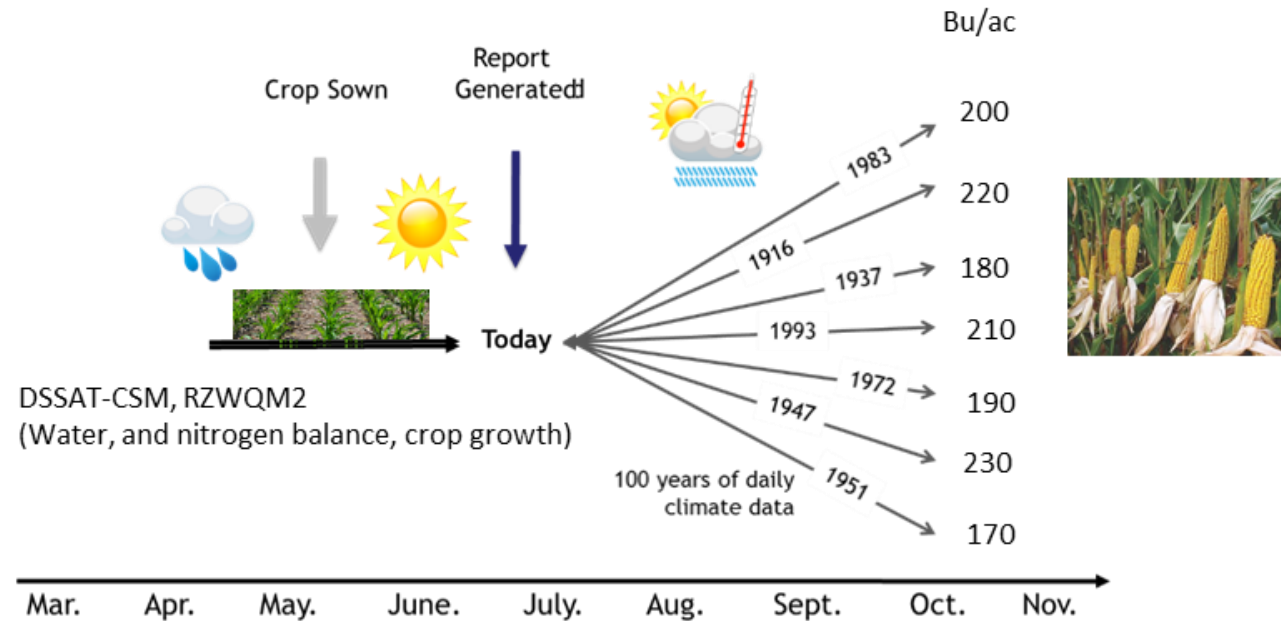
Modified from Yield Prophet: http://www.yieldprophet.com.au/YP/HowItWorks.aspx

S x G x E x M interactions

Crops currently supported in iCrop

- Alfalfa
- Corn
- Cotton
- Tomatoes
- Sorghum
- Rice
- Canola
- Sunflower
- Wheat

UCDAVIS

Ex. Modeling plant growth and development for corn

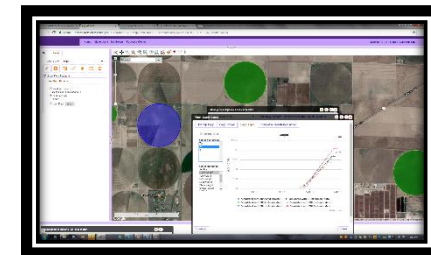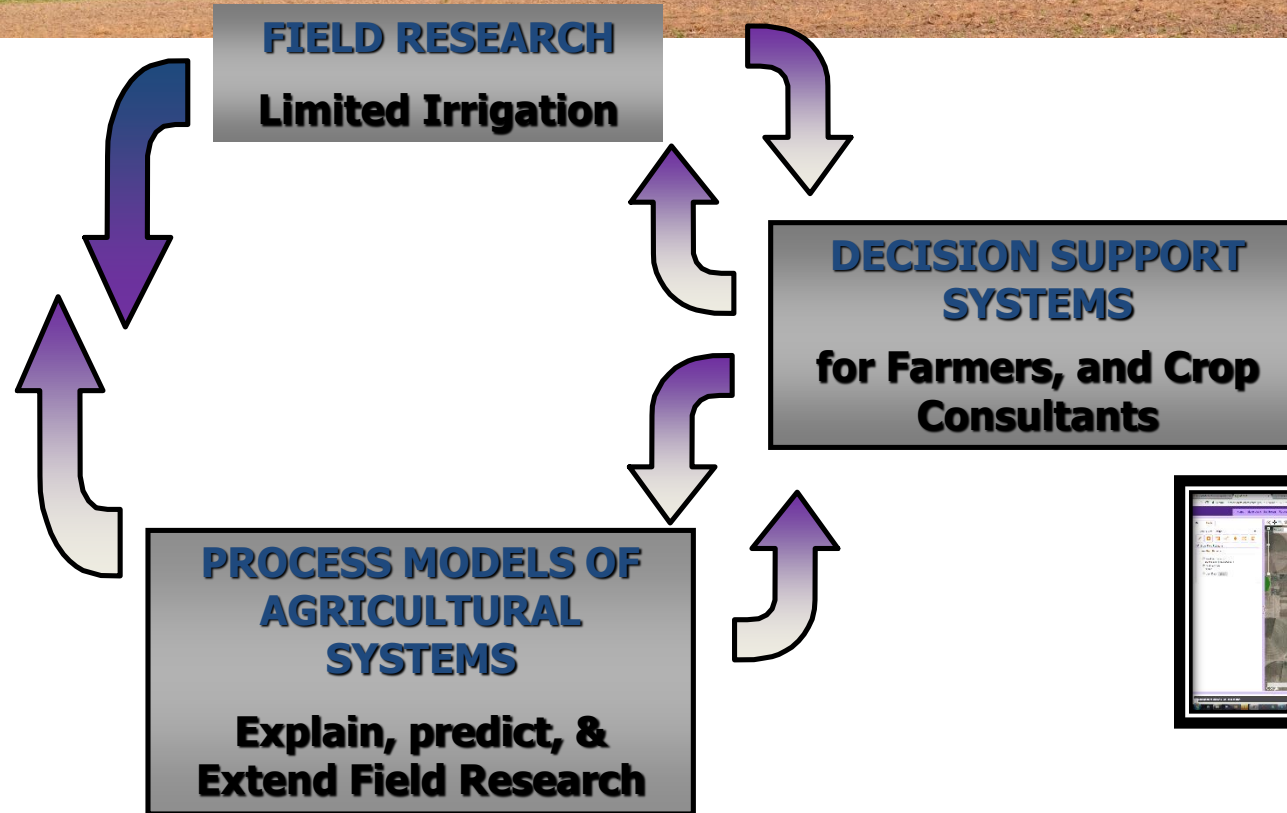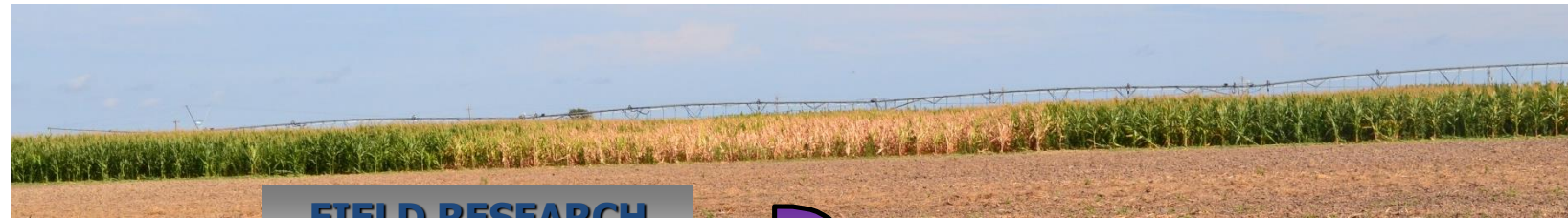$$PCARB = \frac{RUE \times PAR}{PLTPOP}\left(1 - e^{(-k \times LAI)}\right) \times CO_2$$

$$CARBO = PCARB$$
$$\times \min\left[1, \left(PRFT, SWFAC, NSTRES, (1 - SATFAC)\right)\right]$$
$$\times PGFAC3$$

From Experiments to Models to Decision Support

FIELD RESEARCH

Limited Irrigation

DECISION SUPPORT SYSTEMS

for Farmers, and Crop Consultants

PROCESS MODELS OF AGRICULTURAL SYSTEMS

Explain, predict, & Extend Field Research

iCrop

UC DAVIS

DSSAT-CSM CERES-Maize

Calibration
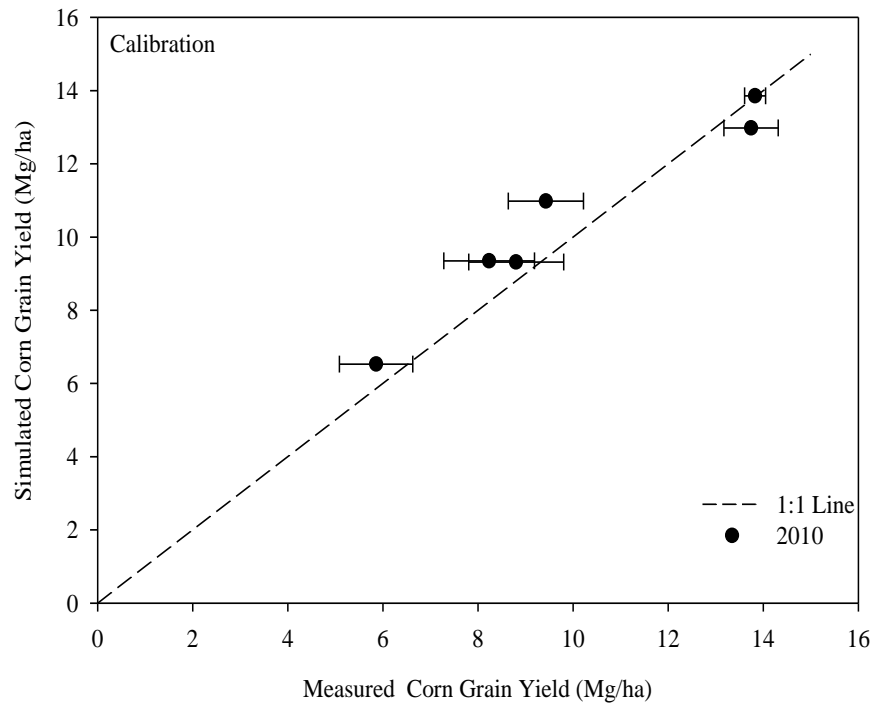
Validation
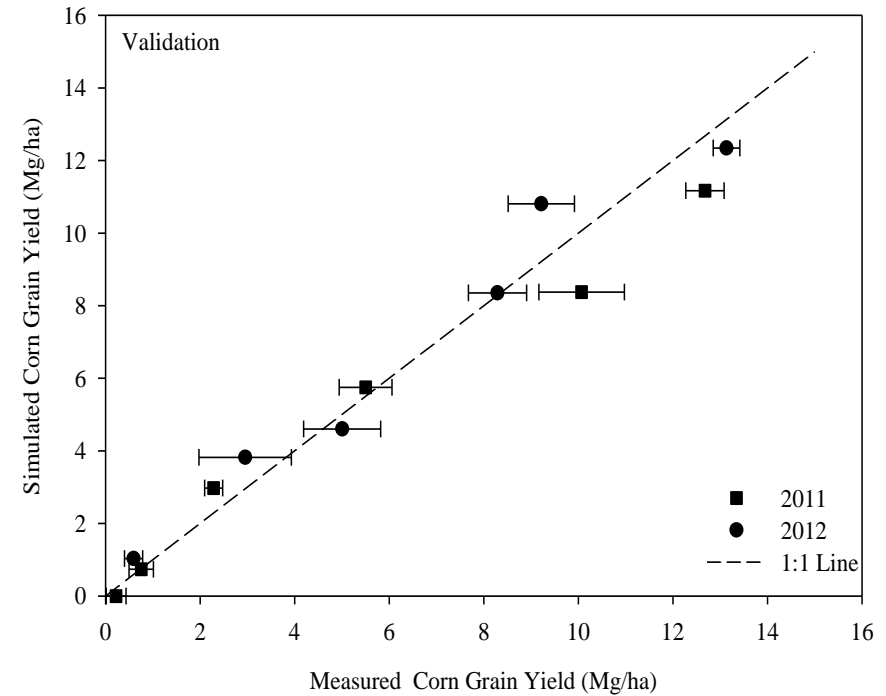
Kisekka et al. 2016

Adding a Field in iCrop

Irrigation Scheduler in iCrop

Example: Regulated Deficit Irrigation for Corn

Regulated Deficit Irrigation Treatments

- 50% Plant Available Water (PAW)
- 75% PAW
- 75%-40% PAW
- 40%-75%-40% PAW
- 50%-80% PAW

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ikisekka | ICROP_share | Help | Sign C

Fields

ect Field: Davis Ex ▼

ow Field Polygons

Weather Stations

⦿ Weather Stations
  -State Stations (MESONET or CIMIS)

○ Gridded Data
  -PRISM

○ User Data   refresh

Click on the search button to display a list of
weather stations closest to your crop field(s).
After collecting, you can click on each station
to see its location and related weather
information.

If any data is missing, it will be filled out
using PRISM or monthly average of data.

Radius: 20 ▼ miles

CIMIS
🔆 Davis (3.2 mi)
⚪ Dixon (11.3 mi)
⚪ Winters (11.3 mi)

Management Options For Field Davis Ex

Select Scenario: 75%PAW ▼   **Create New Scenario**   **Duplicate Scenario**   **Delete Scenario**

Select Cropping System for Field   Save   Import   <Choose> ▼

Year #	Date	Operation	Par 1	Par 2	Par 3		
1	03/31/2017	Tillage	Tandem disk			✚	✖
1	05/01/2017	Nutrient	Urea	300	1	✚	✖
1	05/01/2017	Planting	Maize	25000	2650-2700 GDD	✚	✖
1	05/01/2017	Irrigation	Sprinkler	1		✚	✖
1	09/30/2017	Harvest				✚	✖

Advanced Options   Submit   Done

12:39 AM

Advanced Options

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Map   **Fields**

Select Field: Davis Ex

🗑 ow Field Polygons

▼ **Weather Stations**

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◯ Gridded Data
   -PRISM
◯ User Data refresh

Click on the search but
weather stations close
After collecting, you ca
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If any data is missing,
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Radius: 20 ▼ miles
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Soil Analysis	Initial Conditions	**Irrigation Management**	Soil Management

Irrigation Option:	Automatic ▼
Area irrigated (ac):	290
Amount per irrigation (in):	1
Efficiency (%):	95
Water supply (gpm):	1500
Management depth for automatic application (ft):	4
Method for automatic applications code:	IR001
End point for automatic appl., % of max. available:	100
☑ Irrigation trigger (% of Max Available in the soil) for Planting	75
☑ Irrigation trigger (% of Max Available in the soil) for Germination	75
☑ Irrigation trigger (% of Max Available in the soil) for Flora initiation	75
☑ Irrigation trigger (% of Max Available in the soil) for 75% Silking	75
☑ Irrigation trigger (% of Max Available in the soil) for Beginning Grain Fill	40
☑ Irrigation trigger (% of Max Available in the soil) for End Grain Fill	40
☑ Irrigation trigger (% of Max Available in the soil) for Maturity	40

* Please choose at least one Irrigation Trigger if Automatic with fixed amounts at each irrigation date was selected.

Save   Close

Advanced Options   Submit   Done

https://beta.erams.com/group/178/ma/32576/map/?maName=ICROP_share&key=627c343a-f462-11e6-9562-bc5ff499a18d#swat_data_tabs-8

Type here to search   12:39 AM 02/06/2018

Advanced Options

Soil Analysis | **Initial Conditions** | **Irrigation Management** | **Soil Management**

Parameter	Value
Color, moist, munsell hue:	BK
Albedo, fraction:	0.10
Evaporation limit, cm:	6.00
Drainage rate, fraction/day:	0.50
Runoff curve number (SCS):	75.00
Mineralization factor (0 - 1):	1.00
Photosynthesis factor (0 - 1):	1.00
pH in buffer determination method:	SA001
Phosphorus, extractable, determination:	SA001
Potassium determination method:	SA001

Additional Parameters:

SLB	SLMH	SLLL	SDUL	SSAT	SRGF	SSKS	SBDM	SLOC	SLCL	SLSI	SLCF	SLNI	SLHW	SLHB	SCEC	SADC
5	A	0.120	0.241	0.392	1.00	0.96	1.49	1.11	19.85	35.15	-99.0	0.08	7.11	-99.0	23.7	-99.0
15	A	0.132	0.253	0.396	0.85	0.80	1.51	0.93	21.75	34.20	-99.0	0.06	7.19	-99.0	20.8	-99.0
30	AB	0.147	0.269	0.400	0.70	0.62	1.54	0.71	24.28	33.07	-99.0	0.05	7.28	-99.0	20.2	-99.0
60	BA	0.161	0.283	0.405	0.50	0.49	1.59	0.45	26.65	31.72	-99.0	0.04	7.40	-99.0	21.1	-99.0
100	B	0.160	0.282	0.405	0.38	0.50	1.65	0.26	26.56	31.09	-99.0	0.04	7.54	-99.0	21.2	-99.0
200	BC	0.150	0.269	0.400	0.05	0.61	1.70	0.14	24.85	30.86	-99.0	0.05	7.71	-99.0	21.2	-99.0

Save | Close

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Fields

ct Field: Davis Ex   ▼

w Field Polygons

Weather Stations

● Weather Stations
   -State Stations (MESONET or CIMIS)

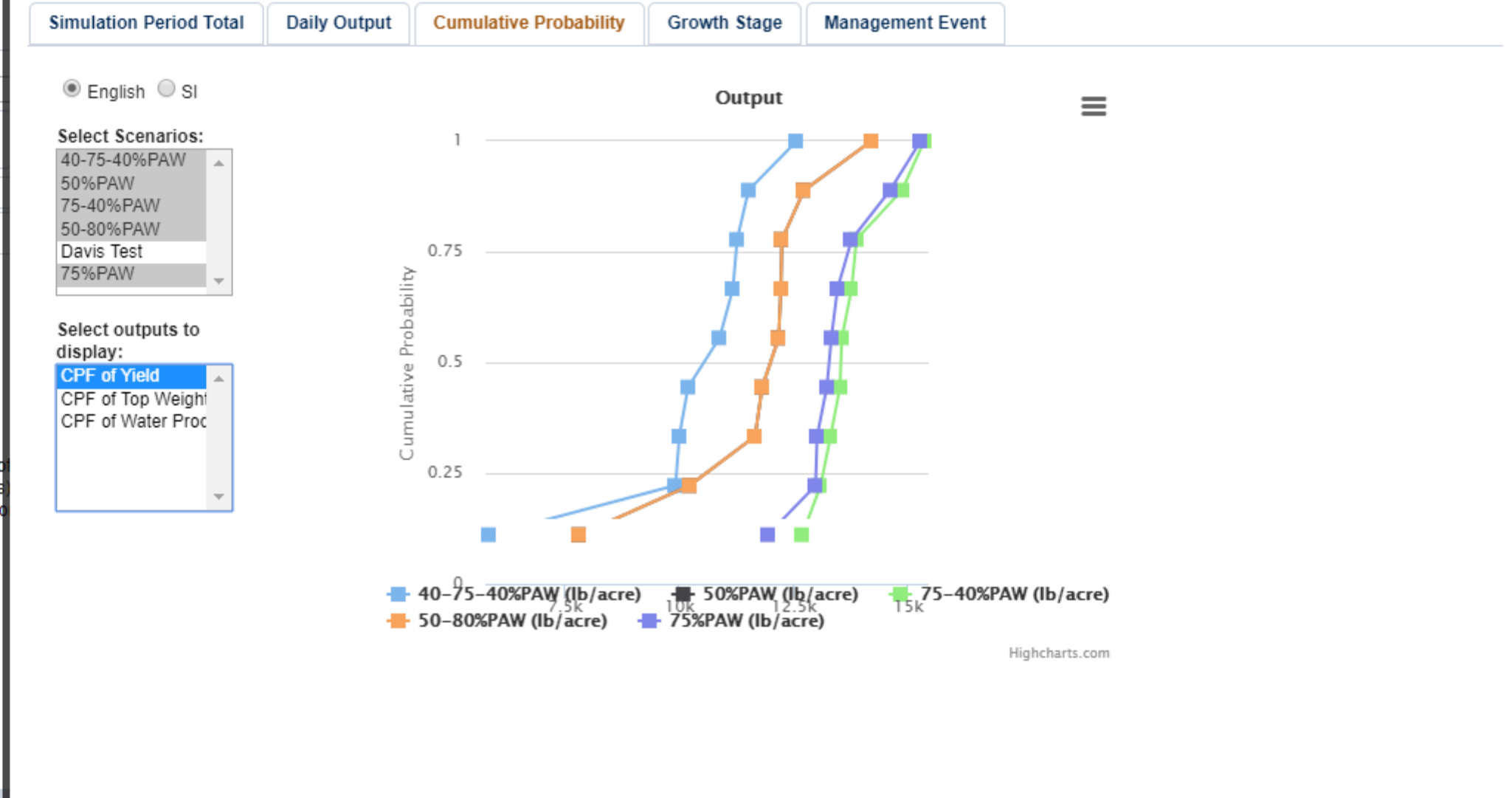○ Gridded Data
   -PRISM

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1	05/01/2017	Planting	Ma		2650-2700 GDD	➕	❌
1	05/01/2017	Irrigation	Sp			➕	❌
1	09/30/2017	Harvest				➕	❌

Running DSSAT

Advanced Options   Submit   Done

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Output

| Simulation Period Total | Daily Output | **Cumulative Probability** | Growth Stage | Management Event |

Fields

lect Field: Davis Ex

w Field Polygons

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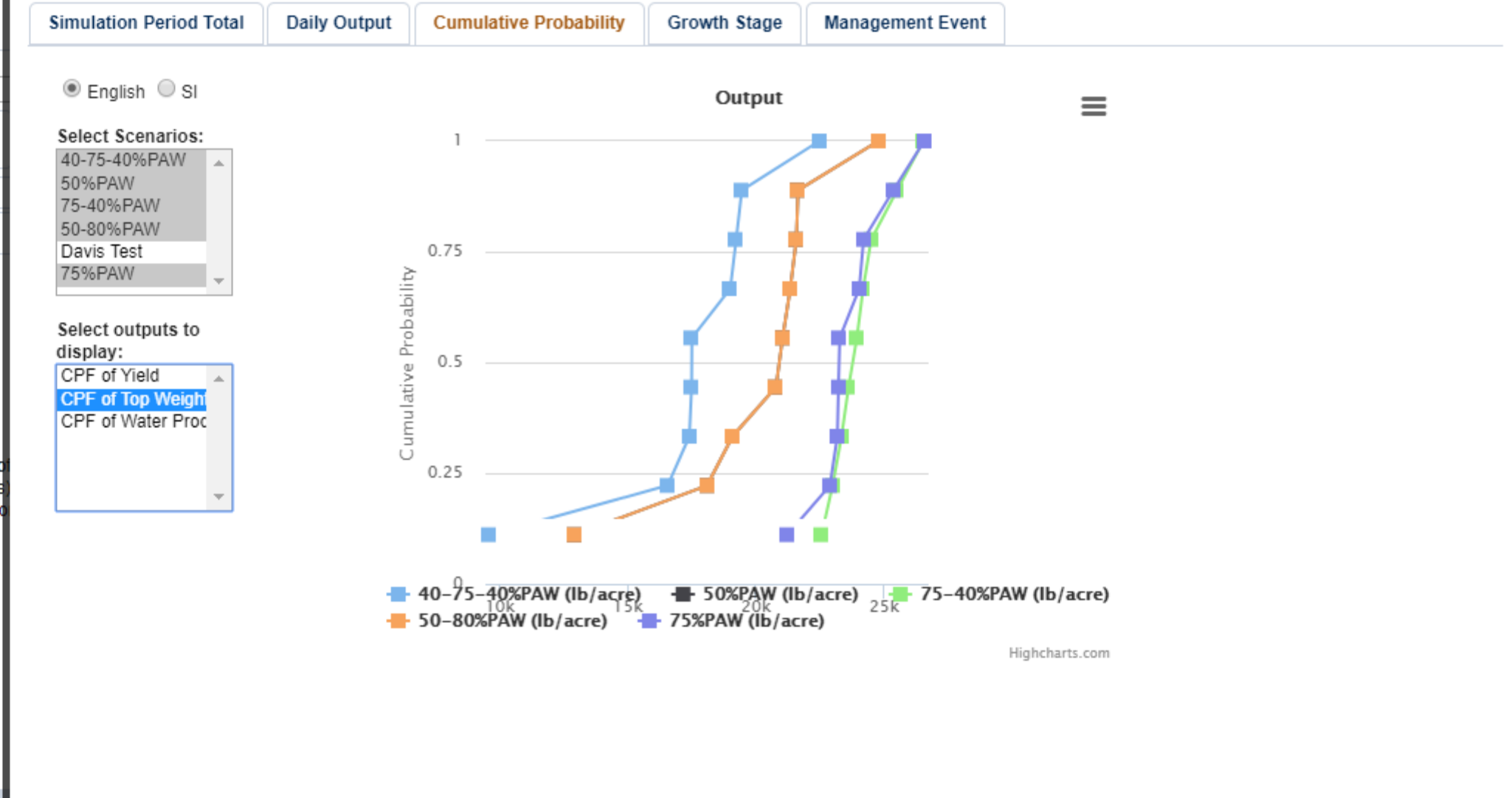- ○ Gridded Data
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⚫ Winters (11.3 mi)

● English   ○ SI

Select Scenarios:

40-75-40%PAW
50%PAW
75-40%PAW
50-80%PAW
Davis Test
75%PAW

Select outputs to display:

CPF of Yield
CPF of Top Weight
CPF of Water Proc

Output

Cumulative Probability (y-axis: 0.25, 0.5, 0.75, 1)

x-axis: 10k, 15k, 20k, 25k

Legend:
- 40–75–40%PAW (lb/acre)
- 50–80%PAW (lb/acre)
- 50%PAW (lb/acre)
- 75%PAW (lb/acre)
- 75–40%PAW (lb/acre)

Highcharts.com

Close

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Output

Fields

| Simulation Period Total | Daily Output | **Cumulative Probability** | Growth Stage | Management Event |

Select Field: Davis Ex

○ English   ○ SI

Output

Select Scenarios:
- 40-75-40%PAW
- 50%PAW
- 75-40%PAW
- 50-80%PAW
- Davis Test
- 75%PAW

Select outputs to display:
- CPF of Yield
- CPF of Top Weight
- **CPF of Water Prod**

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Weather Stations

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Radius: 20 ▼ miles

CIMIS
🟡 Davis (3.2 mi)
⚪ Dixon (11.3 mi)
⚪ Winters (11.3 mi)

Cumulative Probability (y-axis): 0, 0.25, 0.5, 0.75, 1

- 🟦 40–75–40%PAW (lb/acre/inch)
- ⬛ 50%PAW (lb/acre/inch)
- 🟩 75–40%PAW (lb/acre/inch)
- 🟧 50–80%PAW (lb/acre/inch)
- 🟪 75%PAW (lb/acre/inch)

Highcharts.com

Close

12:51 AM

N_stress

Extractable_water (in)

Legend:
- Driest: 2015
- Wettest: 2012
- Observed: 2017
- FC *
- 0.5 PAW **

* FC: Extractable Soil Water at Field Capacity

** 0.5 PAW: Extractable Soil Water at 50% Plant Available Water

Today's H2O_stress (0.0)

Today's N_stress (0.31)

Gauge labels: LOW, MEDIUM, HIGH, VERY HIGH, EXTREME

Cumulative probability output

Yield

Cumulative Probability

(KG/HA)

Water Productivity

Cumulative Probability

(KG/HA/MM)
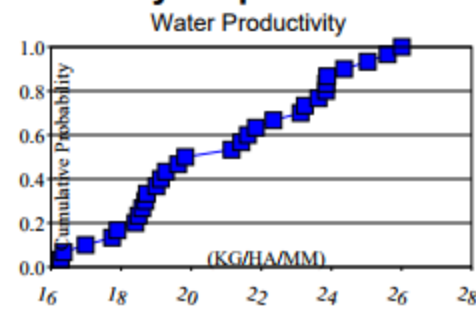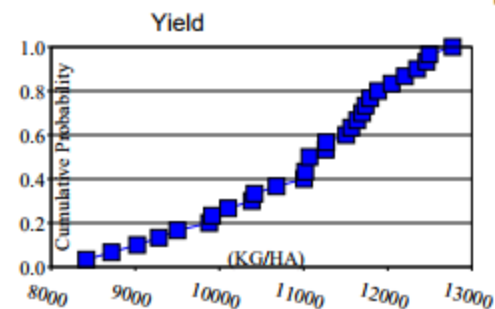
Thank you!

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