KRASS
Khorezm Rural Advisory Support Service

ICARDA
Science for Better Livelihoods in Dry Areas

Екин ҳосилини башоратлашда моделлаштириш (DSSAT) ускуналаридан фойдаланиш

Джуманиязова Юлдуз

Тупроқ ва ўсимлик симуляциялаш модели бу .....

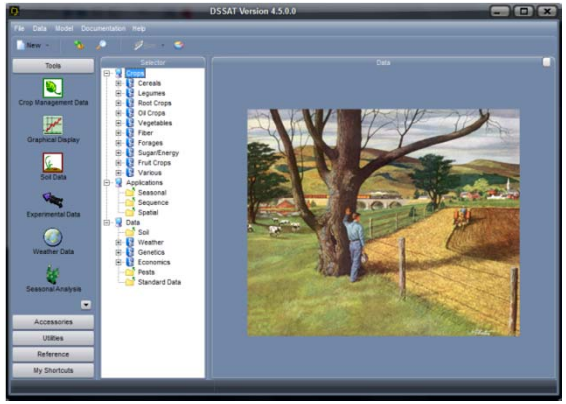
“… динамик симуляцияларни компьютер ёрдамида экин ўсишини сонли интеграцияларда ифодалайдиган компонент методидир“

Sinclair&Seligman, 1996

$$r_{cNS} = \frac{r_c}{\left[1 - \frac{N_{crit} - N_c}{N_{crit} - N_{min}}\right]} \qquad T_N = T_P \frac{+\gamma(1 + r_c/r_a)}{\Delta + \gamma(1 + r_{cNS}/r_a)}$$

$$B_T = B_P \left[\frac{T_A}{T_P}\right] \qquad B_N = B_T \left[1 - \frac{N_{crit} - N_c}{N_{crit} - N_{min}}\right] \qquad Y = B_{PM} HI$$

$$LAI = \frac{SLAB}{1 + pB} \qquad B_{PT} = \frac{K_{BT} T_P}{VPD} \qquad B_{IPAR} = e IPAR$$



Экин ўсишини симуляциялайдиган моделлар асосан қила олади:

- Экин ўсиши ва ҳосил (мумкин бўлган ва хақиқий)
- Сув, тупроқ, N, P ва C динамикалари
- Тупроқ харорати, эвапорация ва транспирация
- (Заракунанда ва касалликлар)

Экин ўсишини симуляциялайдиган моделларда **экин** калибровка қилинади

DSSAT

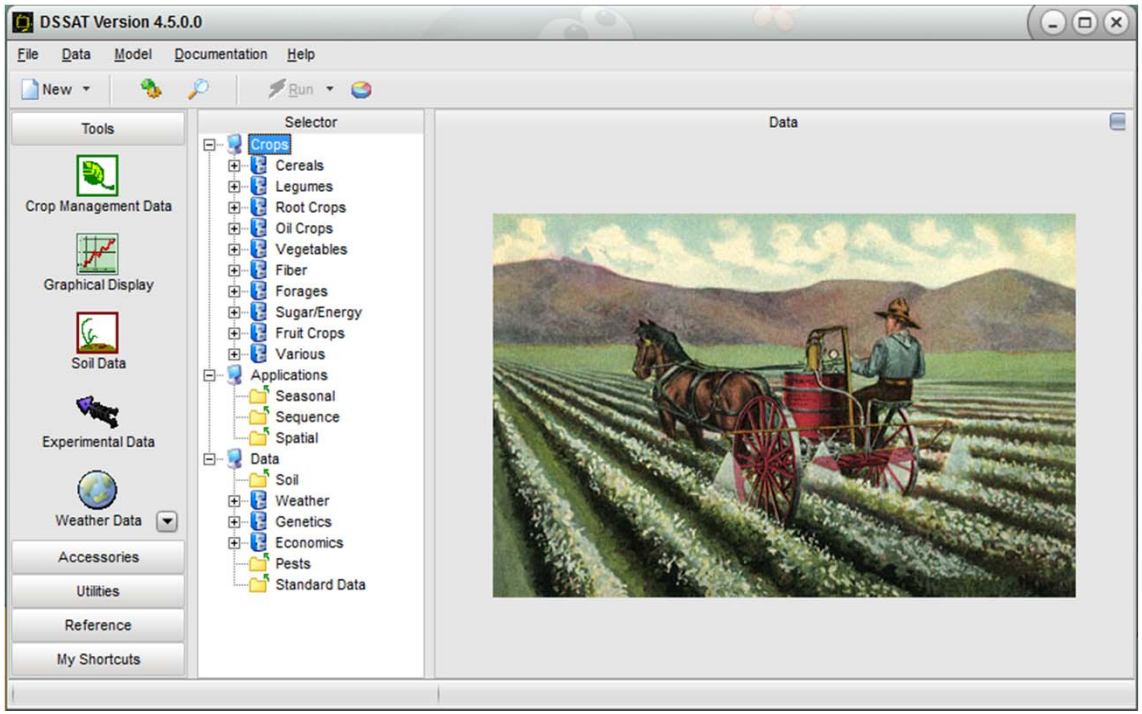
= **D**ecision Support System for Agrotechnology Transfer

- is a software application program that comprises crop simulation models for over 28 crops.
- is supported by data base management programs for soil, weather, and crop management and experimental data, and by utilities and application programs.

- The crop simulation models simulate growth, development and yield as a function of the soil-plant-atmosphere dynamics.
- Distributed free of charge via http://dssat.net/downloads/dssat-v45

DSSAT

- Is used for many applications ranging from on-farm and precision management to regional assessments of the impact of climate variability and climate change.
- has been in use for more than 20 years by researchers, educators, consultants, extension agents, growers, and policy and decision makers in over 100 countries worldwide.



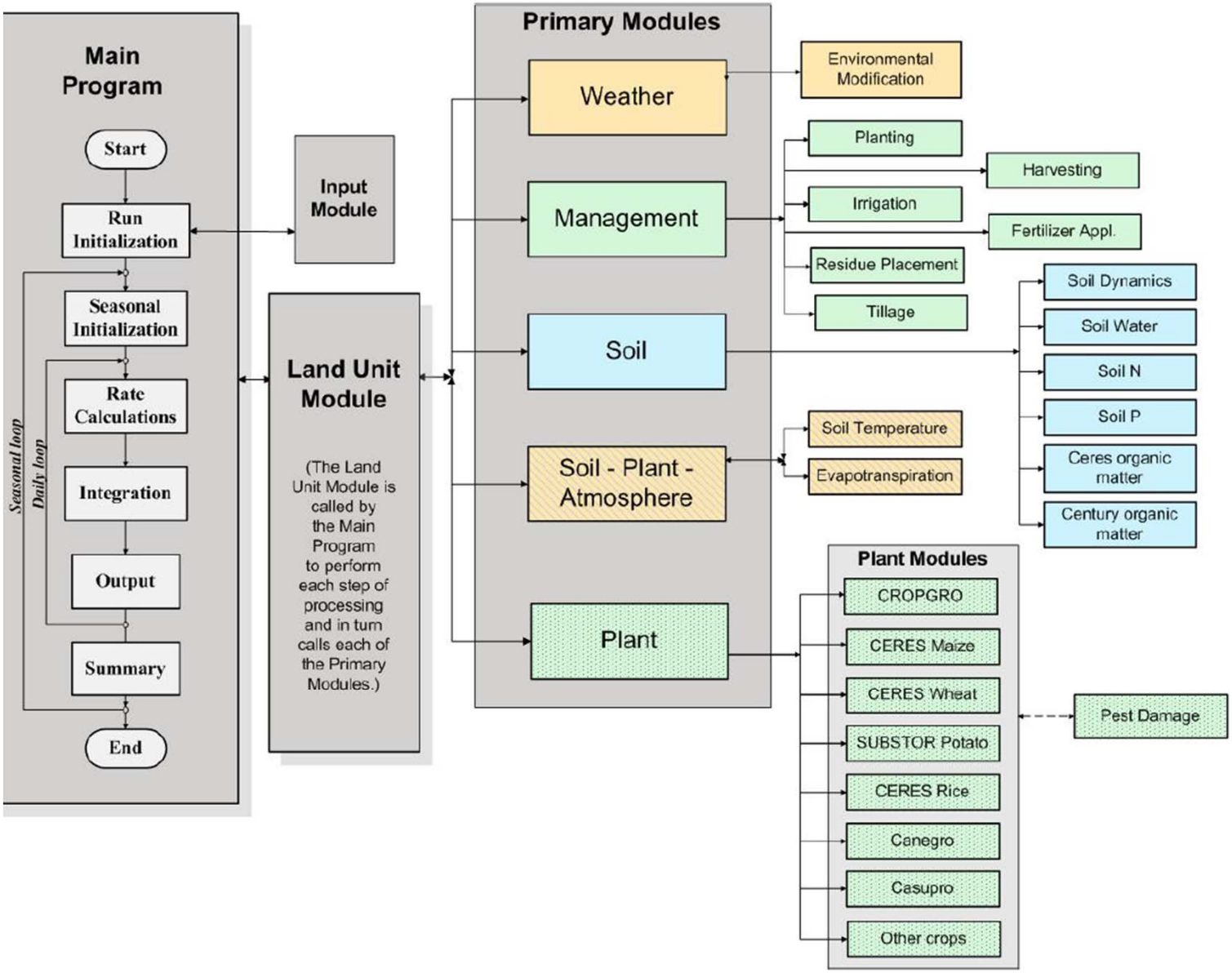


Figure 1. Overview of the components and modular structure of DSSAT-CSM.

Талаб қилинадиган маьлумотлар

Турғун:

Тупроқ:
- Тавсиф
- Структура
- Гидравлик хусусиятлар

Вақт давомида ўзгарувчан:

Тупроқ:
- Тупроқ намлиги
- NO_3-N and NH_4-N
- P
- Органик таркиби
- Химиявий таркиби

Об хаво:
- Ёғингарчилик
- Tmax, Tmin
- Намлик мах, Намлик мин
- Қуёш радиацияси
- Шамол тезлиги

Бошқарув:
- Хайдов
- Суғориш
- Ўғитлаш
- Ҳосил йиғиш

DSSAT

Калибровка учун фойдаланиладиган:

Экин:
- Фенология
- N-ўзлаштириш
- Ер устки биомасса
- Ҳосил

Model calibration and validation

Calibration is the process of modifying the input parameters to a model until the output from the model matches an observed set of data.

Validation is a technique for assessing how the results of calibration will generalize to an independent data set. It is mainly used when one wants to estimate how accurately a predictive model will perform in practice.

$$RRMSE = \frac{\sqrt{\sum (o_i - p_i)^2 / n}}{\sum o_i / n} \times 100$$

$$R = \frac{\sum (o_i - \bar{o})(p_i - \bar{p})}{\sqrt{\sum (o_i - \bar{o})^2 \sum (p_i - \bar{p})^2}}$$

$$I = 1 - \frac{\sum (p_i - o_i)^2}{\sum \left(|p_i - \bar{o}| + |o_i - \bar{o}| \right)^2}$$

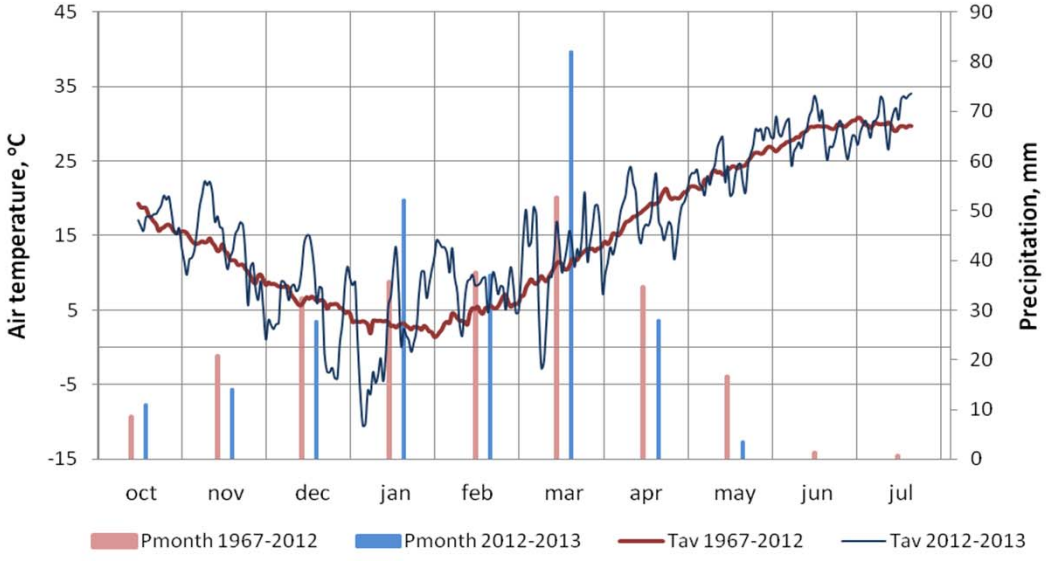
Experimental data

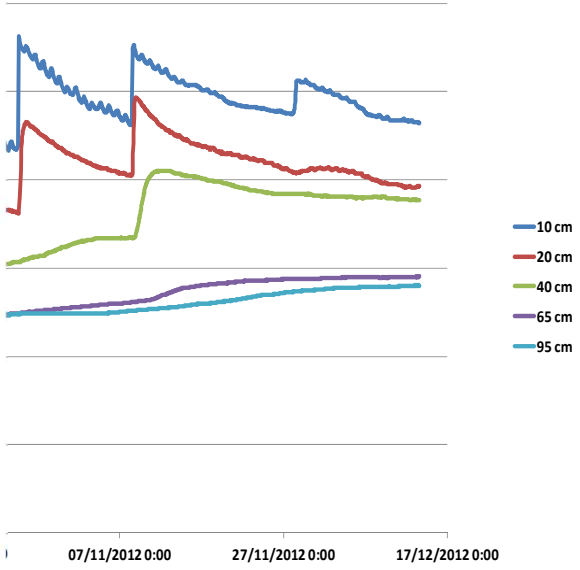
Testing of selected facultative wheat varieties for tolerance to heat stress during flowering at the selected experimental site of Kashkadarya Research Institute of Grain Breeding and Seed Production of Cereal Crops (KRIGBSPCC) in Kovchin village of Karshi district, Kashkadarya region, Uzbekistan

Experimental data

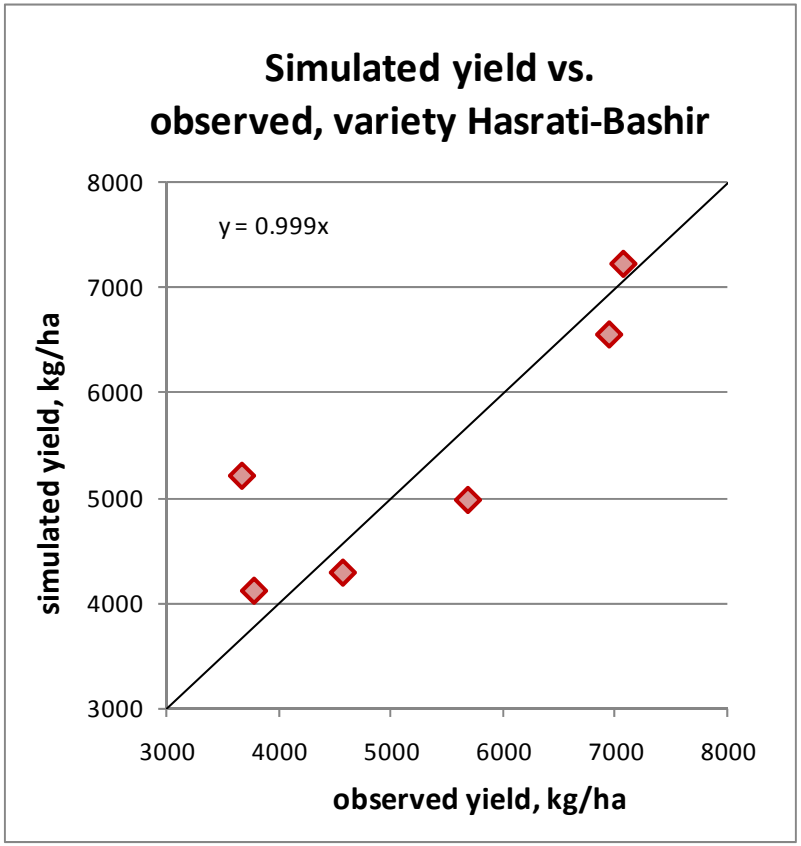
- **Facultative wheat varieties planted**: Bunyodkor, Sanzar 4, Hazrati-Bashir, Saidaziz, Elomon, Gozgon, Humo, Jaihun
- **Dates of sowing**: middle of October, November, and February
- **Data collected**:

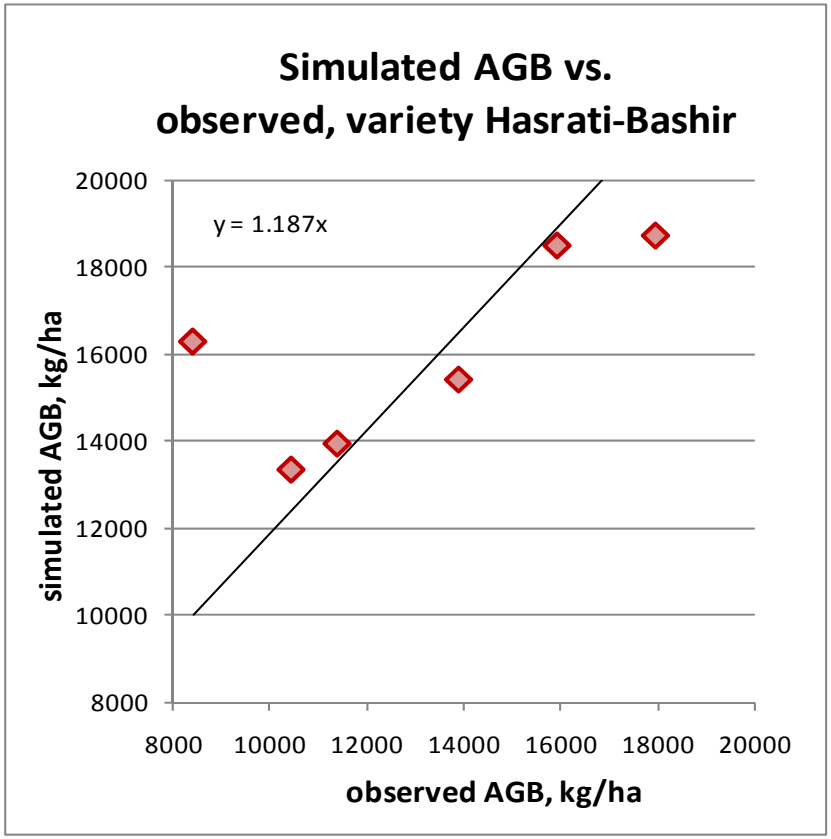
  Weather, Soil, Crop , Management





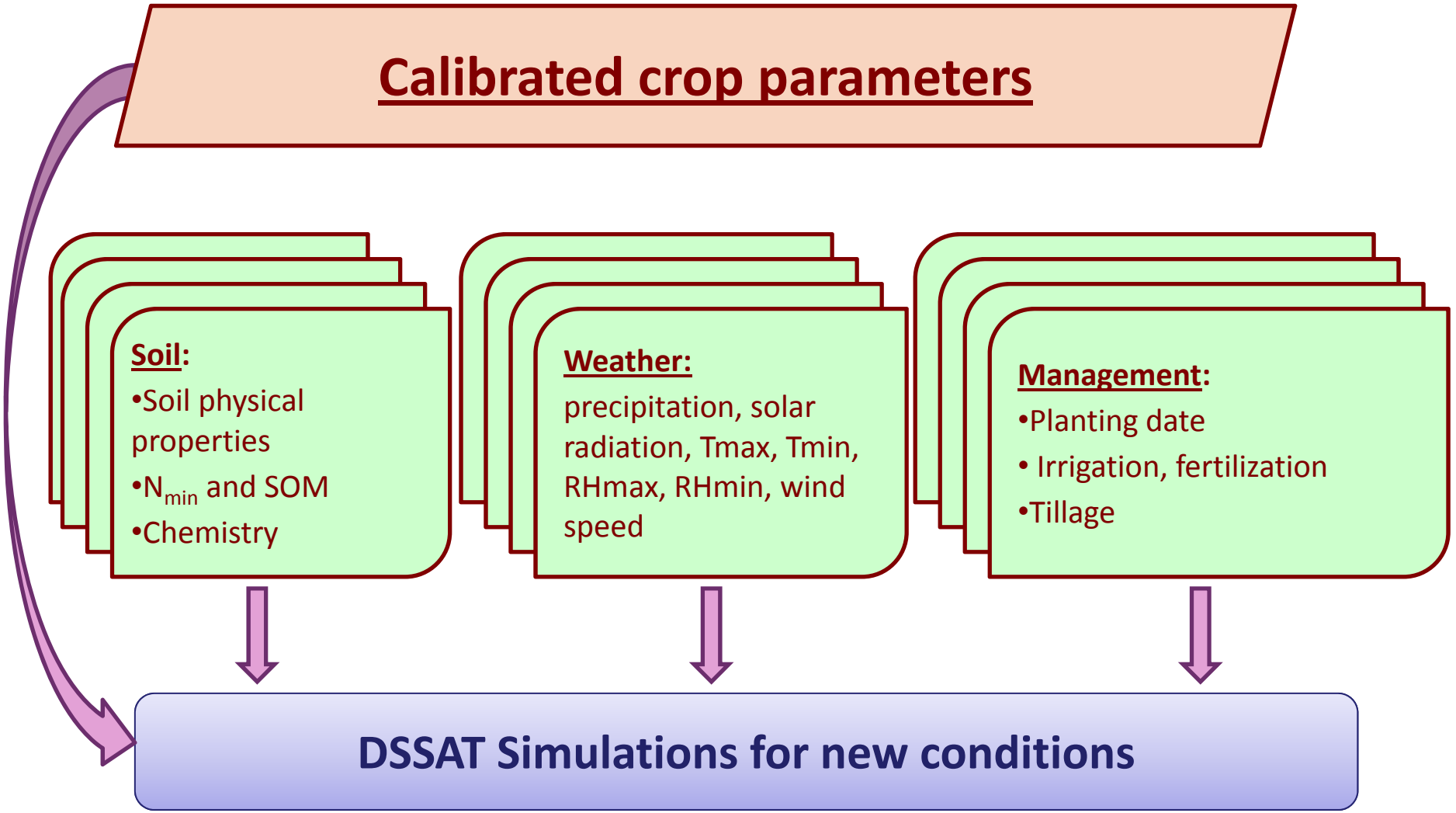
Results of calibration





	RRMSE	Correlation coefficient	Index of agreement
Grain yield	14	0.85	0.91
AGB	29	0.72	0.96

Simulations

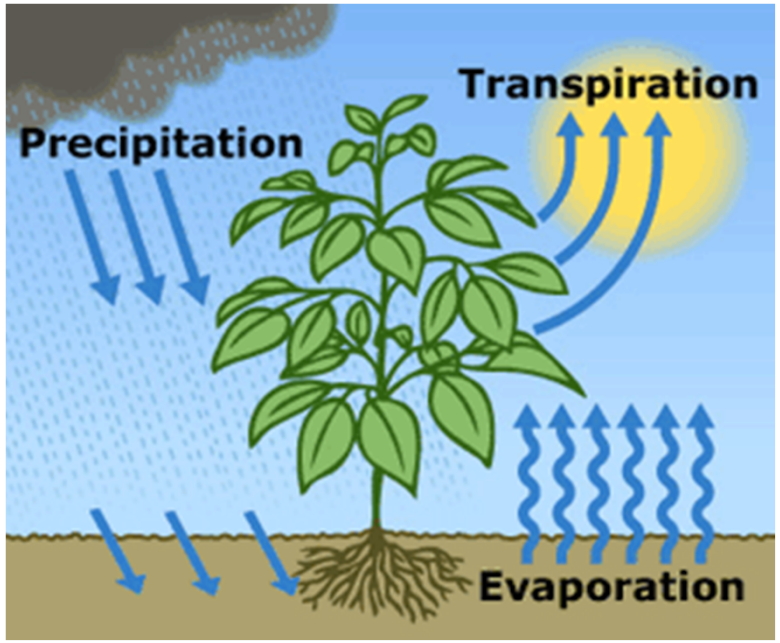


Background

Evapotranspiration (ET) = Evaporation from soil

+

Transpiration by plants



Reference ET

- Reference ET Calculation
  - ASCE-EWRI Standardized ET Equation

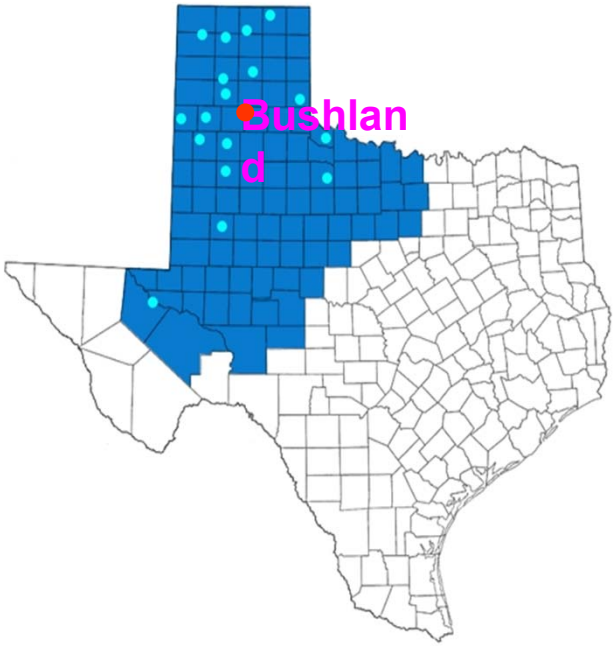
$$ET_{sz} = \frac{0.408\,\Delta\,(R_n - G) + \gamma \frac{C_n}{T + 273}\,u_2\,(e_s - e_a)}{\Delta + \gamma\,(1 + C_d u_2)}$$

Background

- Cotton and Winter Wheat Irrigation
  - ET-based irrigation scheduling in Texas since 1991
    - TXHPET Network – 17 Weather Stations

Reference ET

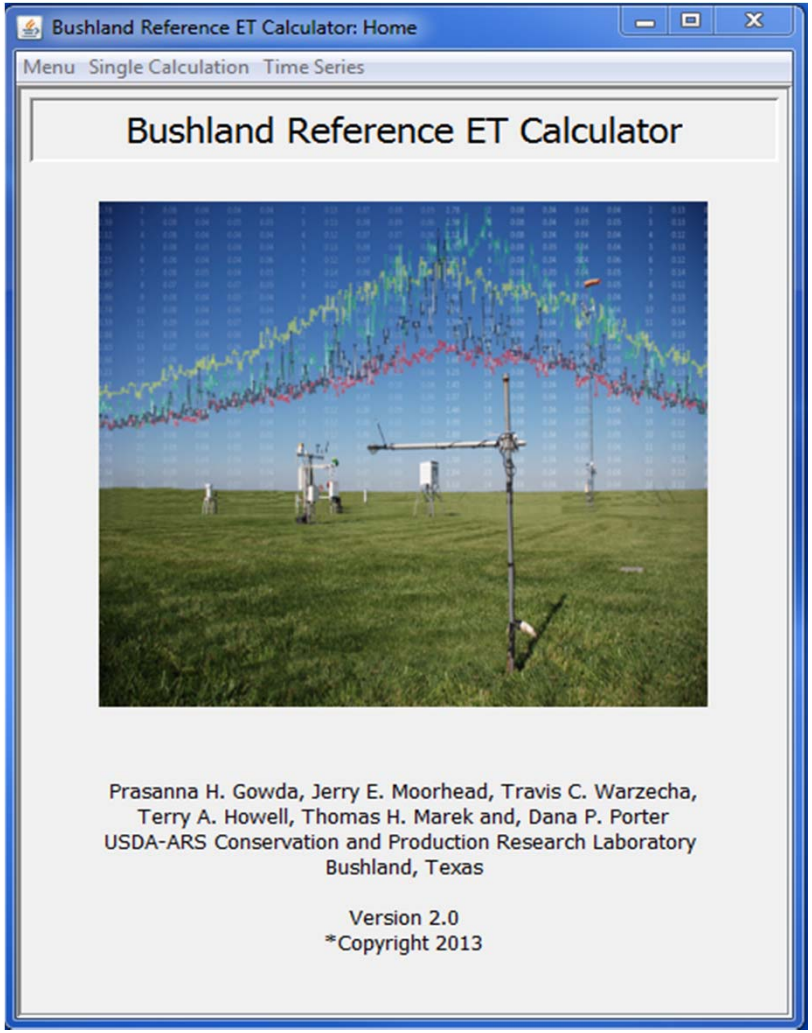
Grass reference ET

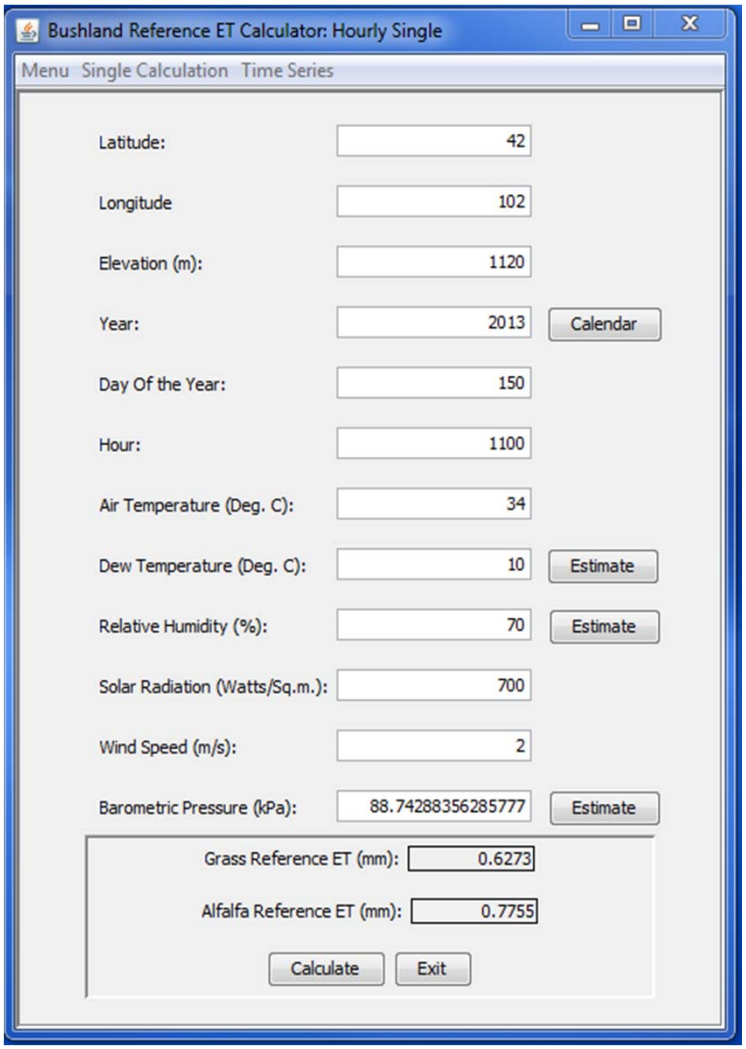


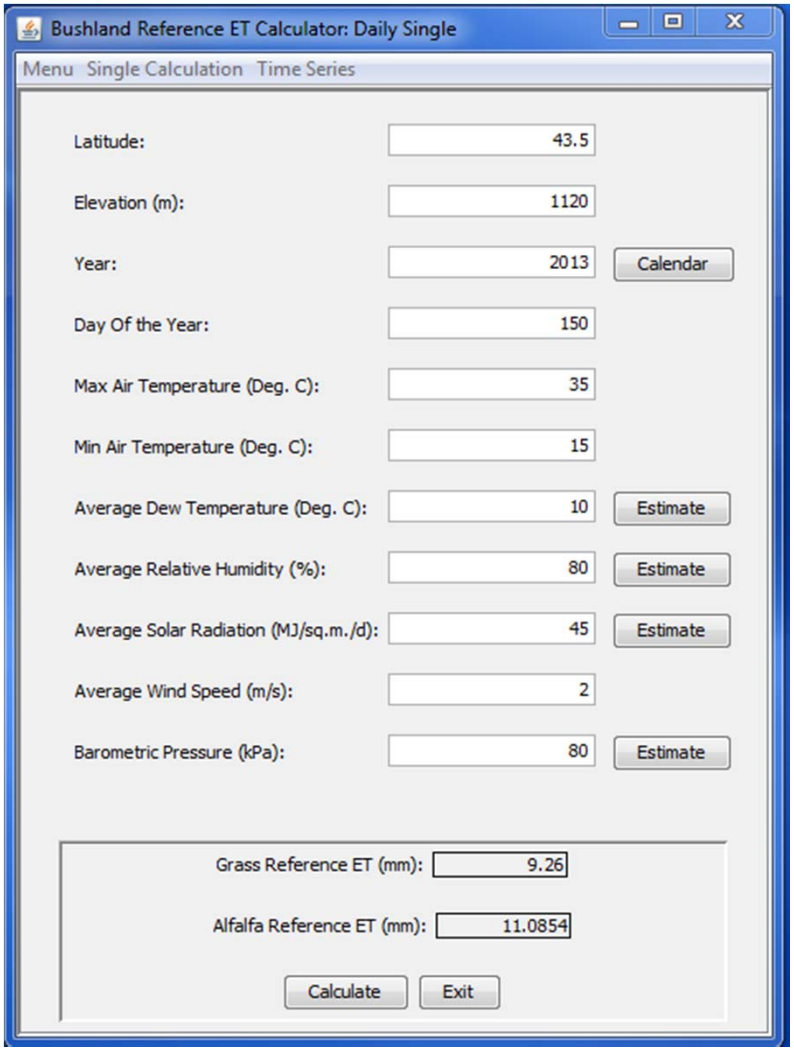
- Need ET
- ET = Kc x Reference ET

Weather Data

From Field Studies
E.g. from KRASS in this case




Bushland Reference ET Calculator: Hourly Single
Menu Single Calculation Time Series
Latitude: 42
Longitude 102
Elevation (m): 1120
Year: 2013 Calendar
Day Of the Year: 150
Hour: 1100
Air Temperature (Deg. C): 34
Dew Temperature (Deg. C): 10 Estimate
Relative Humidity (%): 70 Estimate
Solar Radiation (Watts/Sq.m.): 700
Wind Speed (m/s): 2
Barometric Pressure (kPa): 88.74288356285777 Estimate
Grass Reference ET (mm): 0.6273
Alfalfa Reference ET (mm): 0.7755
Calculate Exit


Bushland Reference ET Calculator: Daily Single
Menu Single Calculation Time Series
Latitude: 43.5
Elevation (m): 1120
Year: 2013 Calendar
Day Of the Year: 150
Max Air Temperature (Deg. C): 35
Min Air Temperature (Deg. C): 15
Average Dew Temperature (Deg. C): 10 Estimate
Average Relative Humidity (%): 80 Estimate
Average Solar Radiation (MJ/sq.m./d): 45 Estimate
Average Wind Speed (m/s): 2
Barometric Pressure (kPa): 80 Estimate
Grass Reference ET (mm): 9.26
Alfalfa Reference ET (mm): 11.0854
Calculate Exit

iPhone APPLICATION

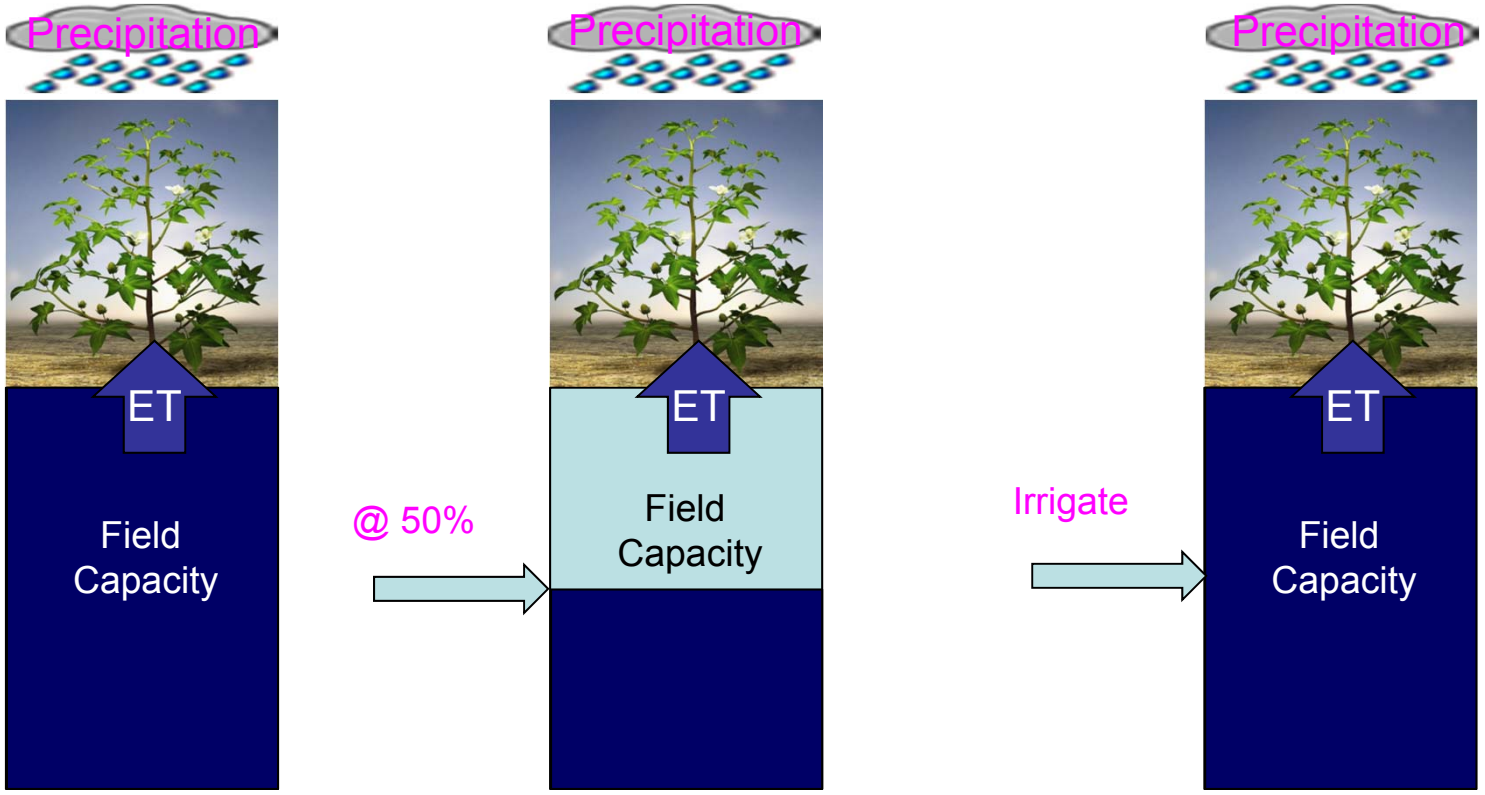
Cover Page Hourly ET Daily ET

Android APPLICATION

Cover Page Hourly ET Daily ET

ET-Based Irrigation Scheduling

- How do we do it?
  - when soil-water level is less than 50%, irrigate.



If WC = 50% of FC, Irrigate

Thank you for your attention!
Hazrati Bashir
REP 1