

FIELD SENSING AND AGRICULTURAL DECISION SUPPORT IN INDONESIA

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Testu ITO (X-Ability)



OBJECTIVES & SCOPES

Objectives:

- To find proper water management in SRI Paddy Fields.
- To know waterflow in the soil of SRI Paddy Field.

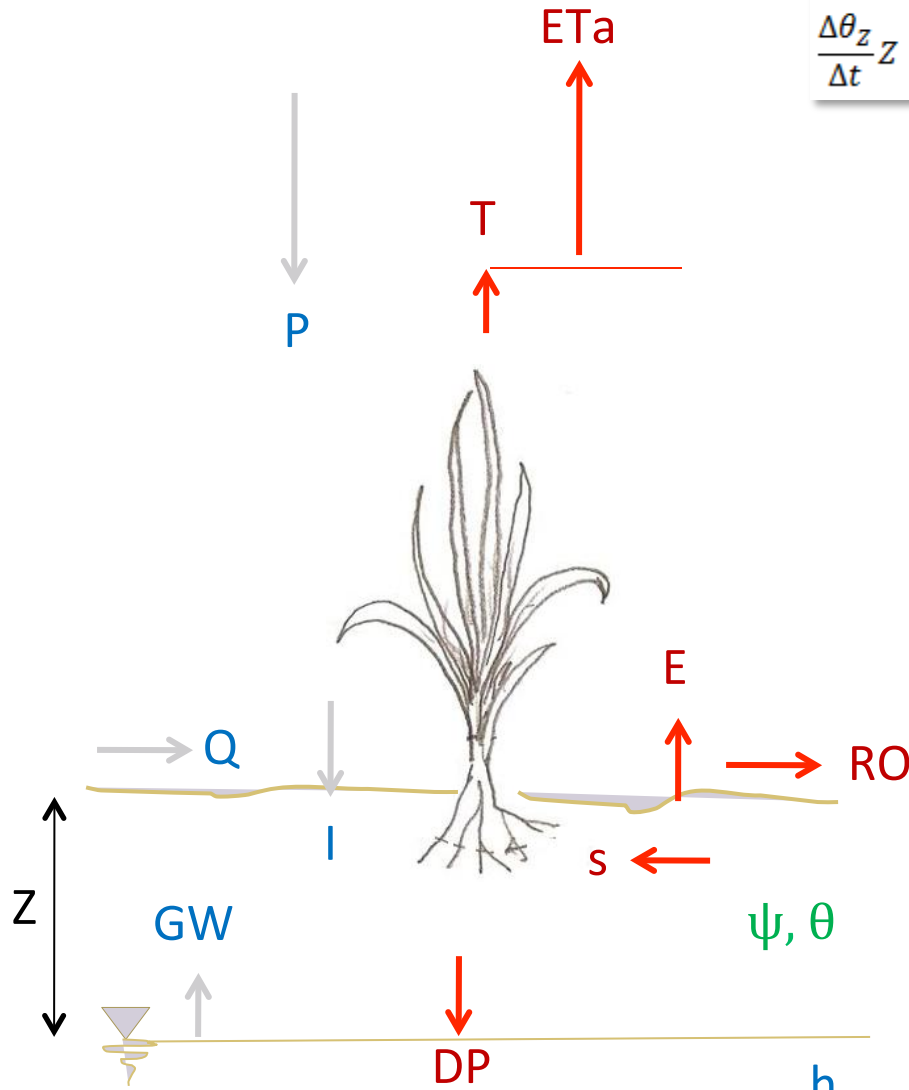
Scopes:

- Water balance analysis
- Analysis of waterflow in the soil
- Micro-climate monitoring
- Soil environment monitoring
- Simulation of waterflow in the soil

SRI PADDY FIELD



THEORETICAL APPROACH



Water Balance Equation:

$$\frac{\Delta\theta_z}{\Delta t} Z = (P + Q + GW) - (RO + DP + ETa)$$

Crop Coefficient:

$$ETa = Kc(t) \cdot ETp$$

Darcy-Richards' equation:

$$\frac{\partial\theta}{\partial t} = \frac{\partial}{\partial z} \left[D \frac{\partial\theta}{\partial z} - K \right] - s(z, t)$$

Diffusivity:

$$D = \frac{K}{C}$$

Specific water capacity:

$$C = \frac{d\theta}{dh}$$

Genuchten's model:

$$\theta = \theta_r + (\theta_s - \theta_r) \left[1 + \left(\frac{h_m - h}{\alpha} \right)^n \right]^{-m}$$

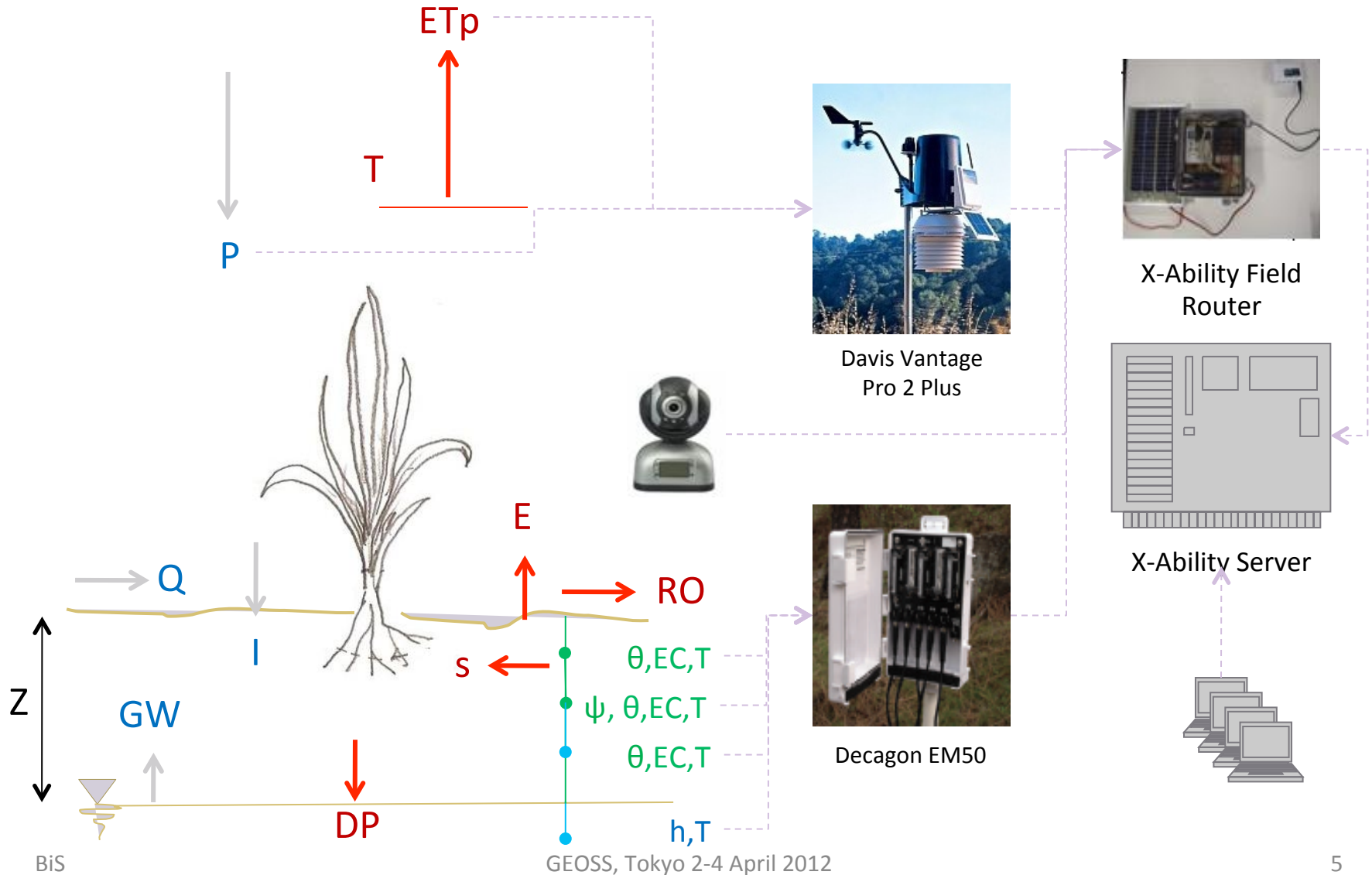
Mualem's model:

$$K = K_s S^\lambda \left[1 - (1 - S^{1/m})^m \right]^2$$

Degree of saturation:

$$S = \frac{\theta - \theta_r}{\theta_s - \theta_r} = \left[1 + \left(\frac{h_m - h}{\alpha} \right)^n \right]^{-m}$$


MEASUREMENT SYSTEM



WEBSITE

<http://emsa-sri.org/>

EMSA-SRI ENVIRONMENTAL MONITORING SYSTEM ON THE ADVANCEMENT OF THE SYSTEM OF RICE INTENSIFICATION



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LATEST FEATURE

EMSA-SRI is a longterm research project conducted to gather environmental data from SRI Paddy Fields. EMSA-SRI was initiated by the Department of Civil & Environmental Engineering, Bogor Agricultural University in collaboration with the Department of Global Agricultural Sciences, the University of Tokyo. The activities of EMSA-SRI in Indonesia was initially funded by the Directorate General of Higher Education, the Ministry of National [...]

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INSTALLED AT 5 LOCATIONS:

- 3 In West Java
- 1 in Bali
- 1 in South Sulawesi

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VISITORS

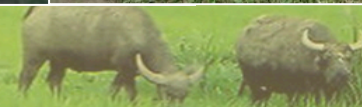
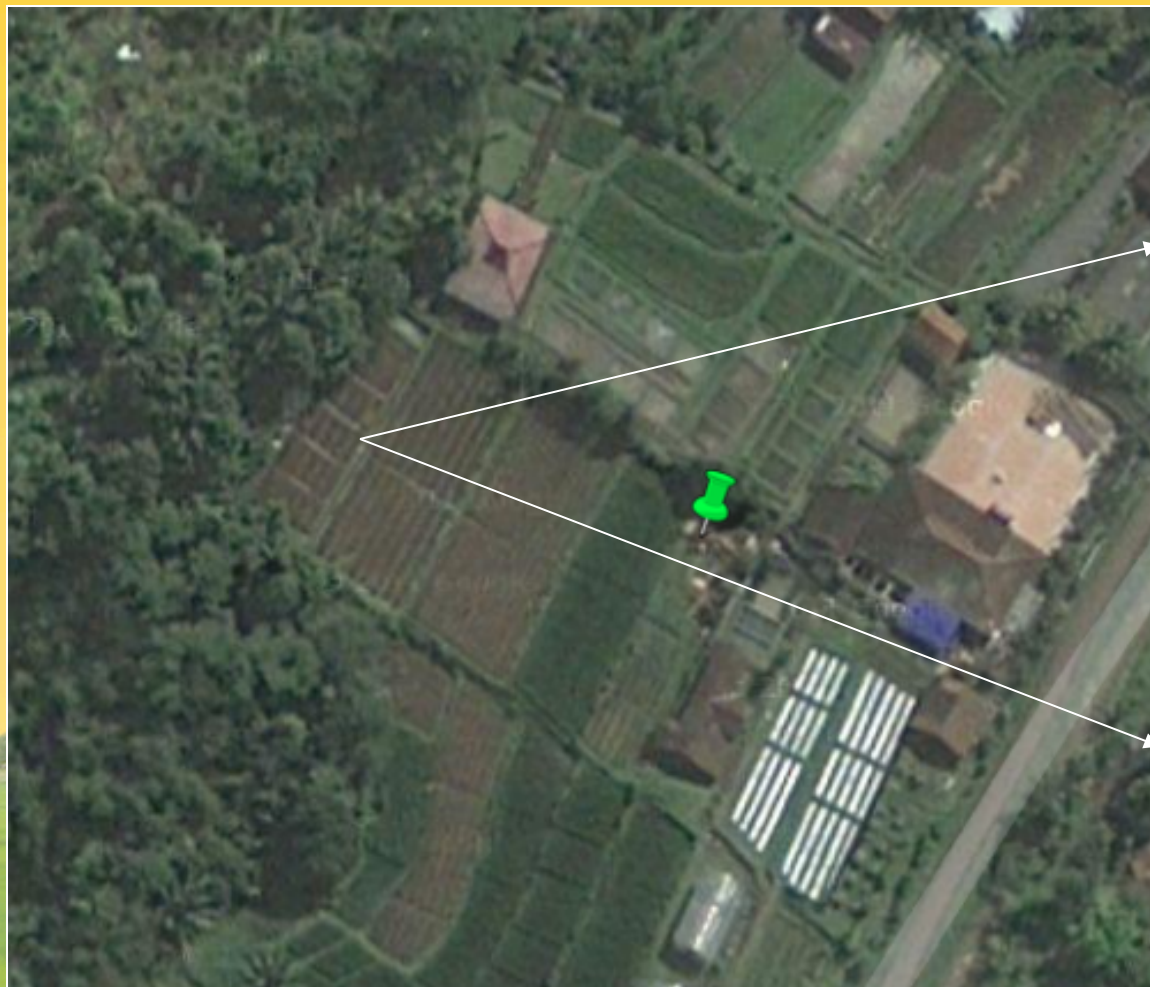
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17 Nov 2010 - 27 Feb 2012



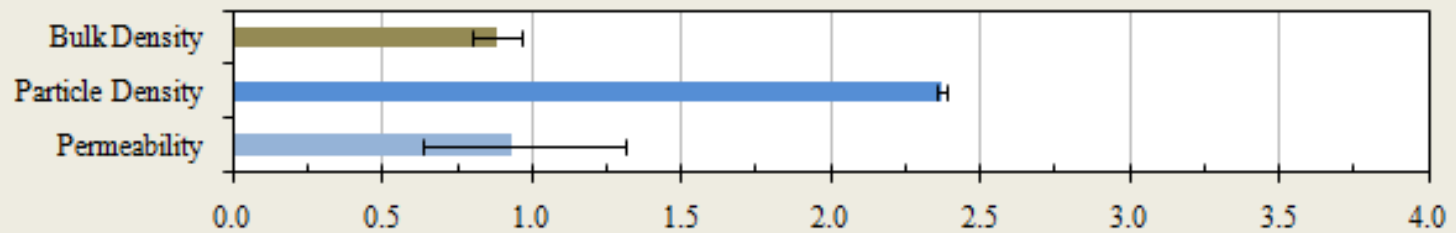
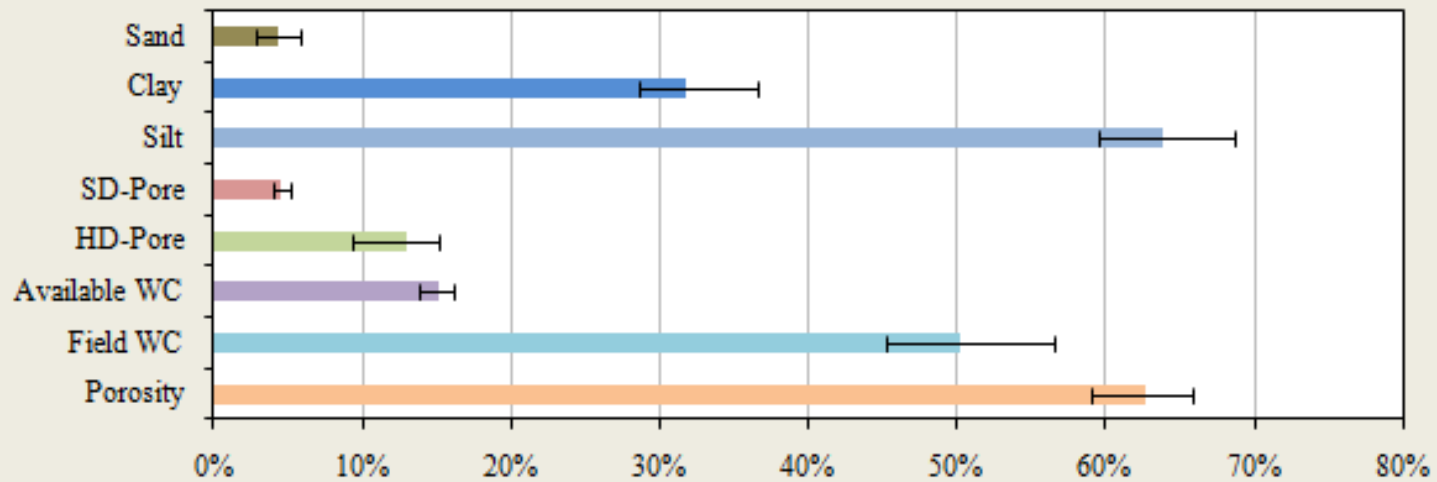
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STUDIED AREA OF SRI PADDY FIELDS

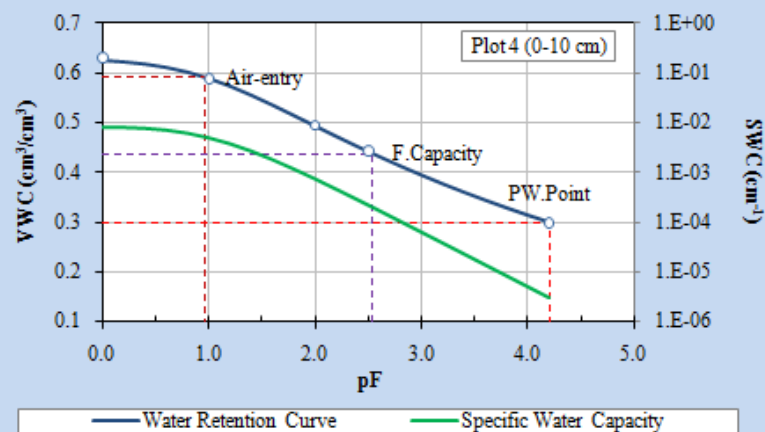
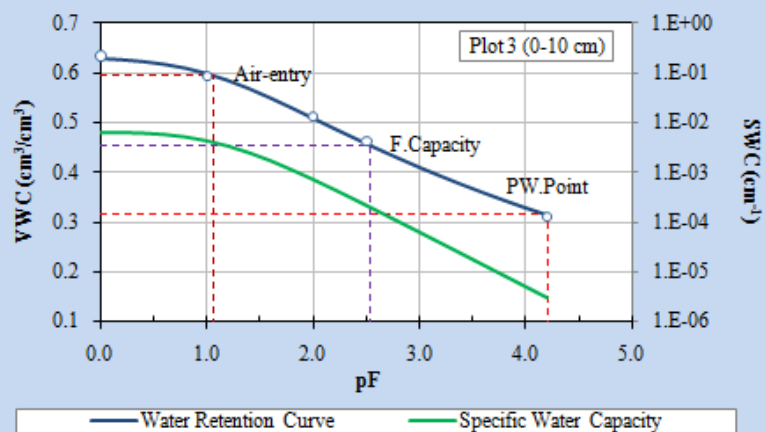
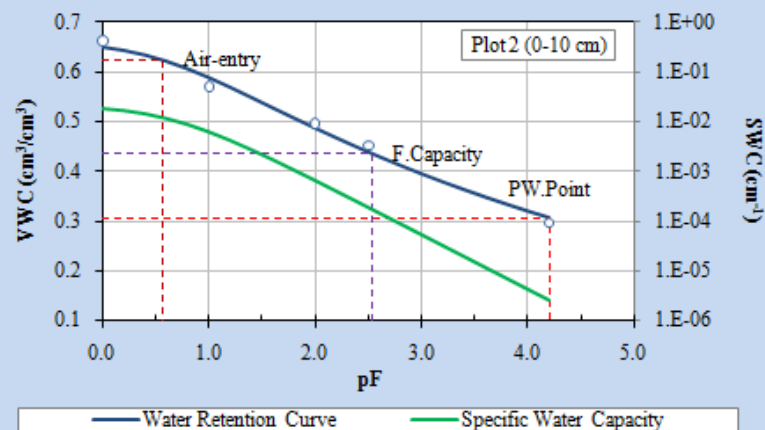
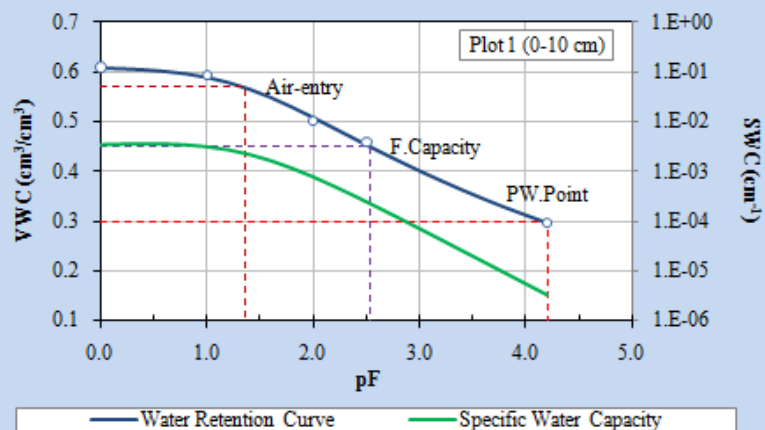
Sukabumi, West-Java



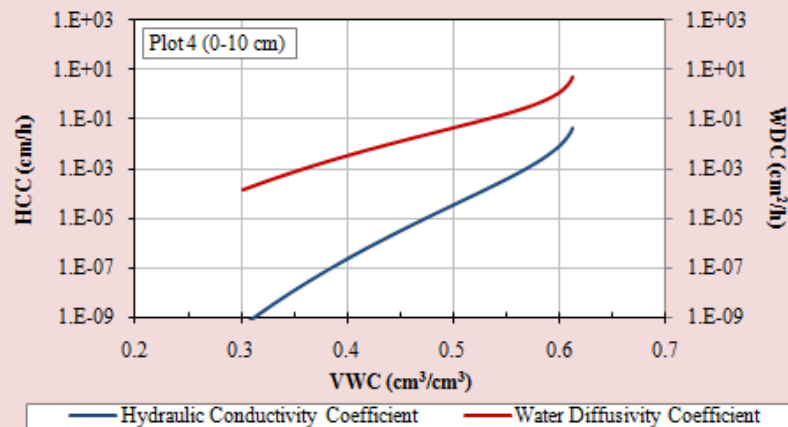
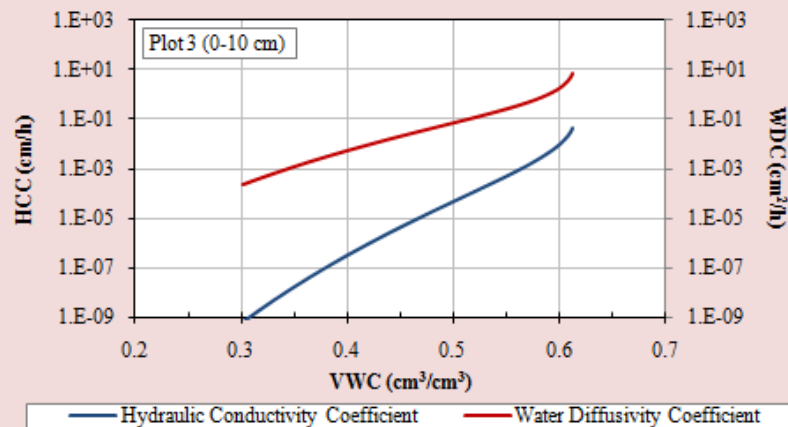
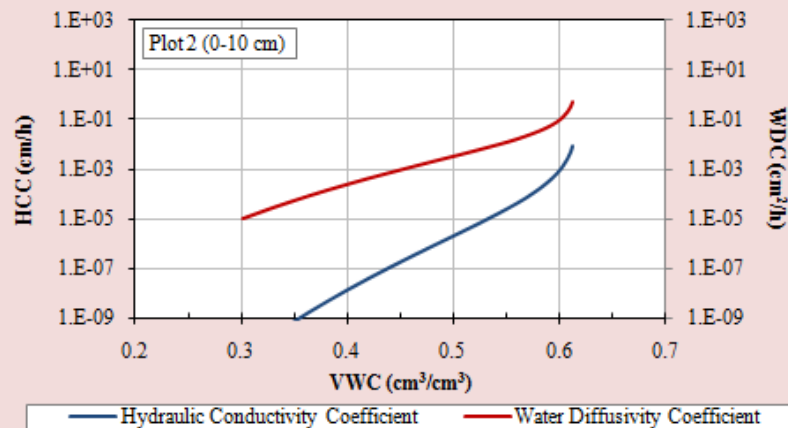
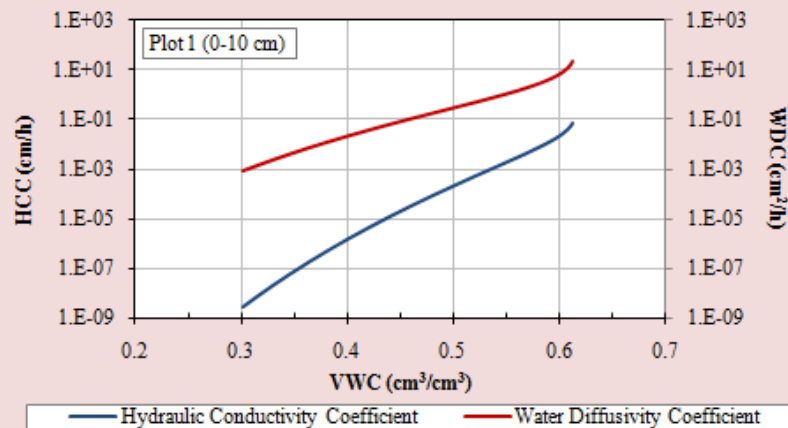
SOIL PHYSICAL PROPERTIES



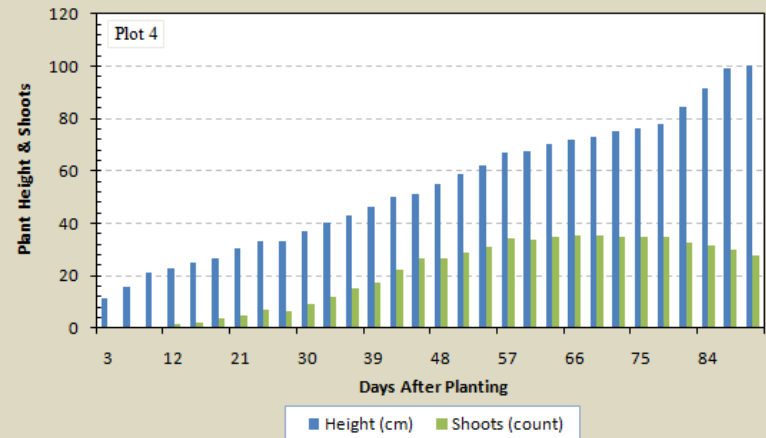
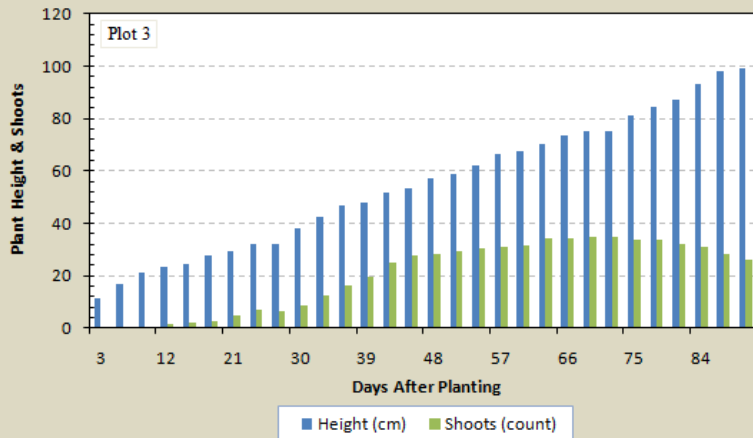
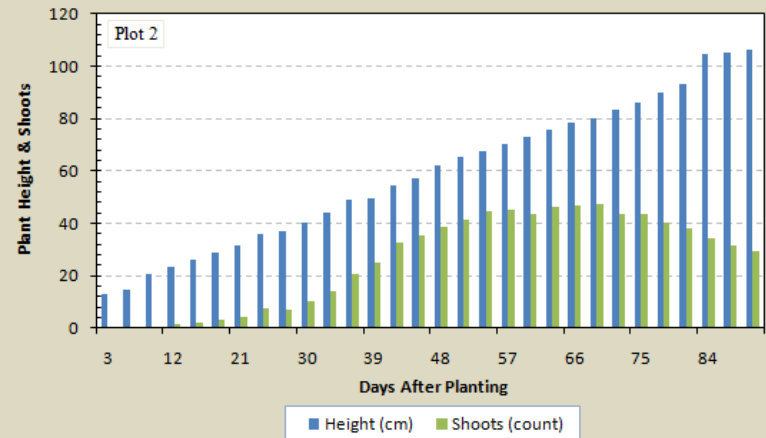
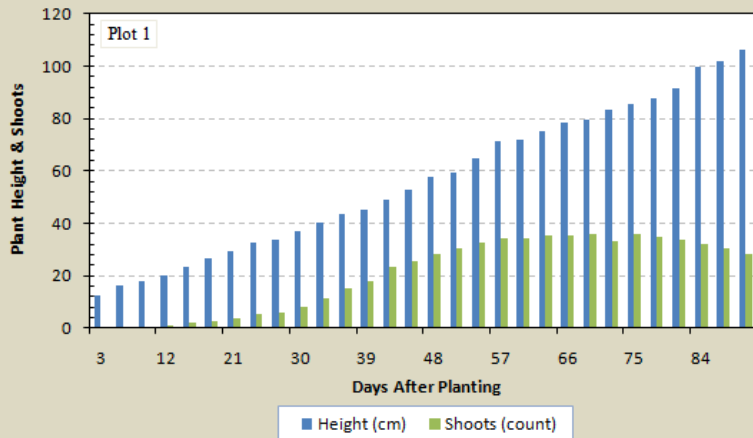
WATER RETENTION CURVES



CONDUCTIVITY & DIFFUSIVITY CURVES

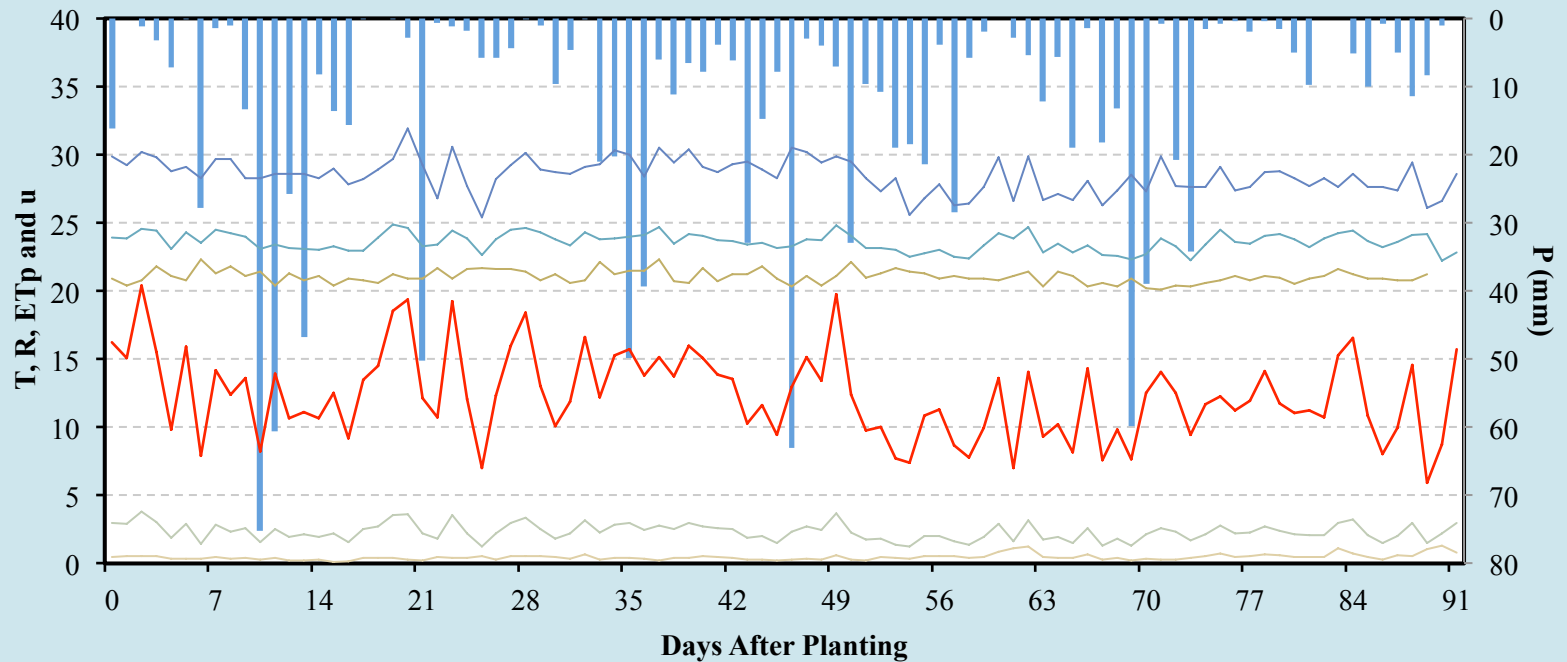


PADDY GROWTHS



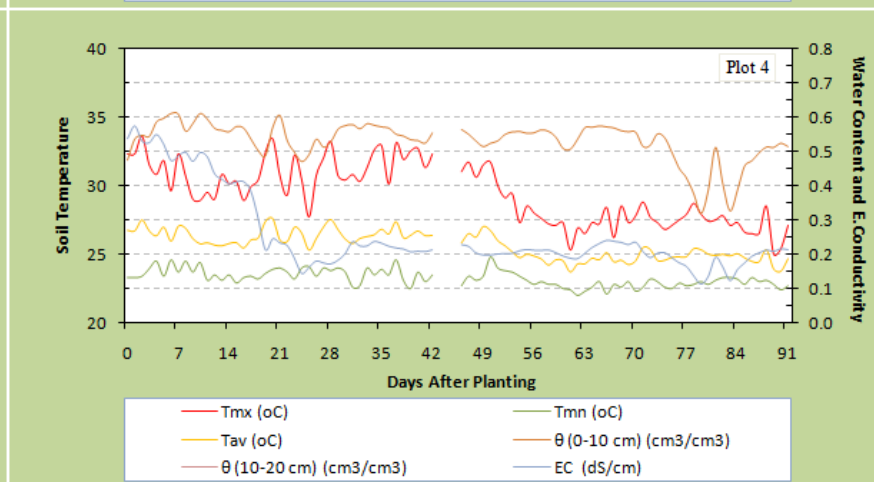
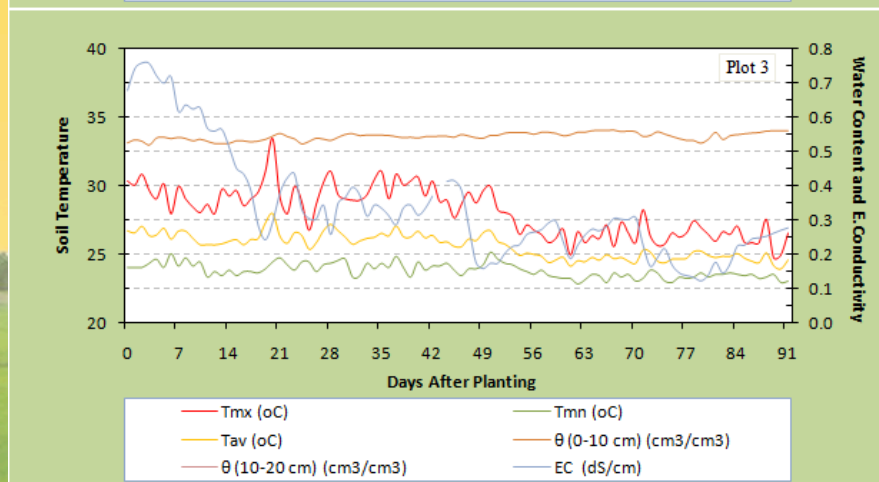
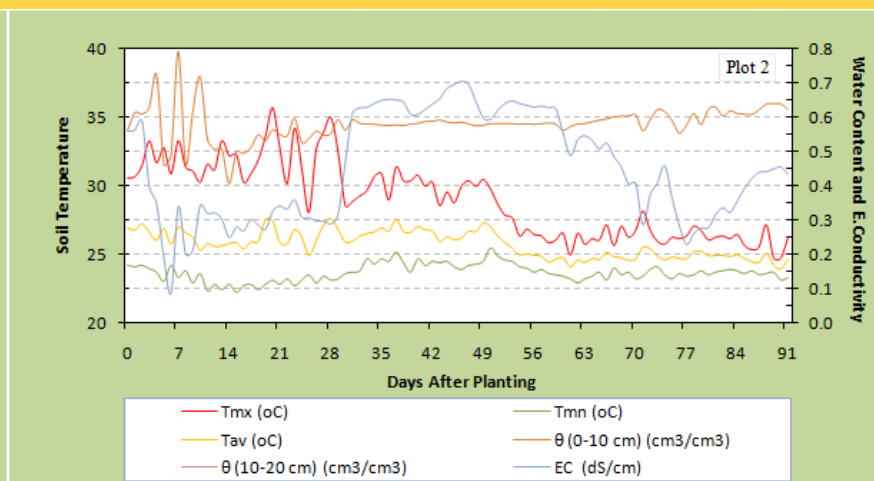
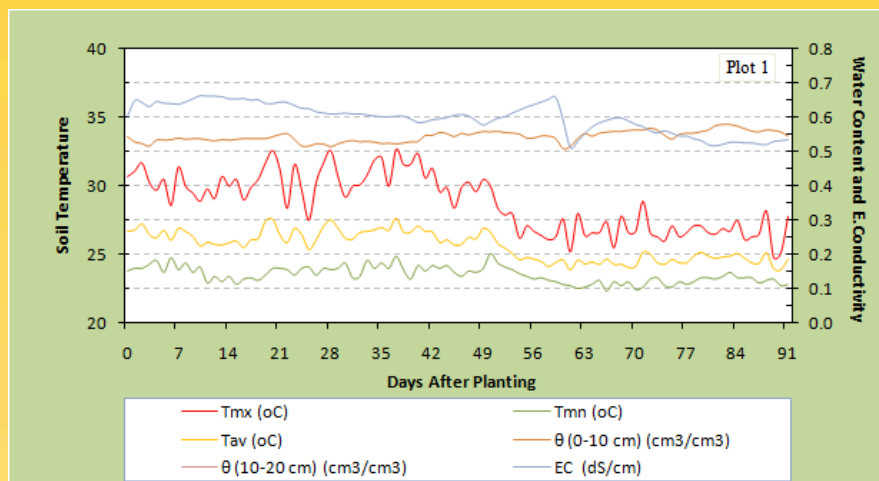
CLIMATE DATA

Weather Data 14 Oct 2010-7 13 Jan 2011

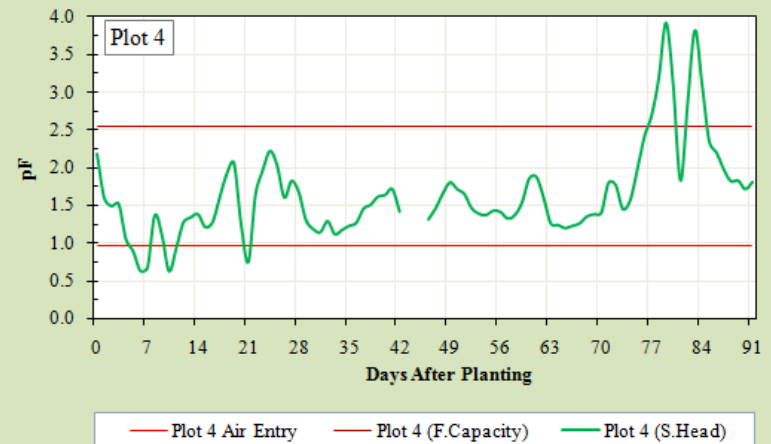
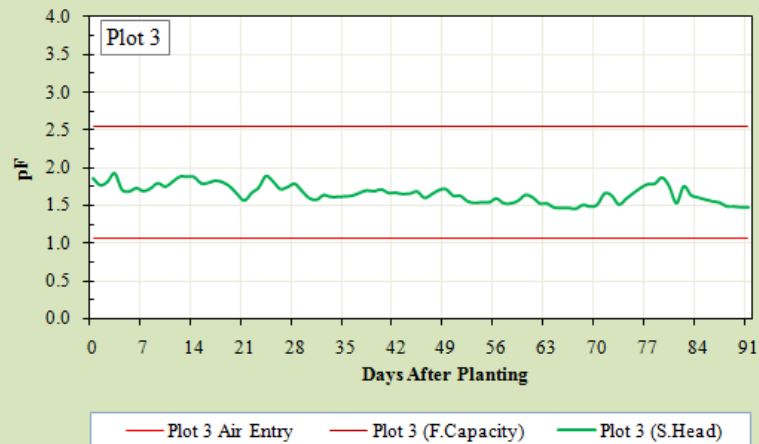
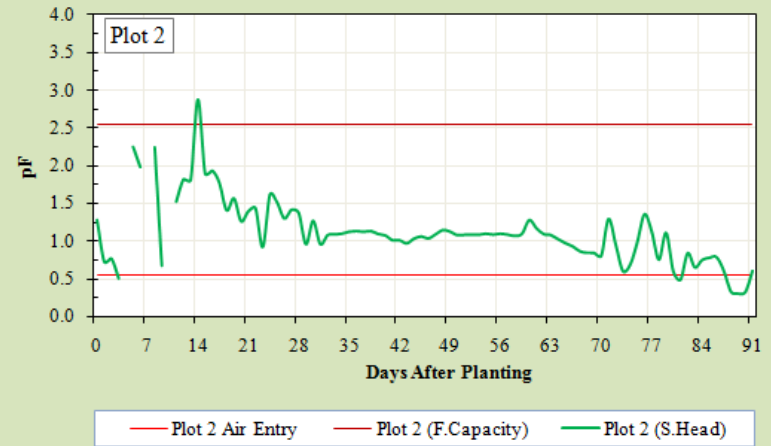
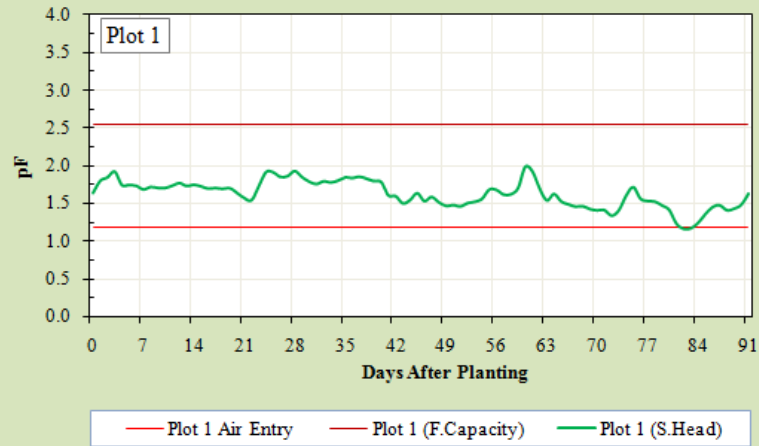


■ P (mm) — Tmx (oC) — Tav (oC) — Tmn (oC) — R (MJ/m2) — ETp (mm) — u (m/s)

SOIL ENVIRONMENTS

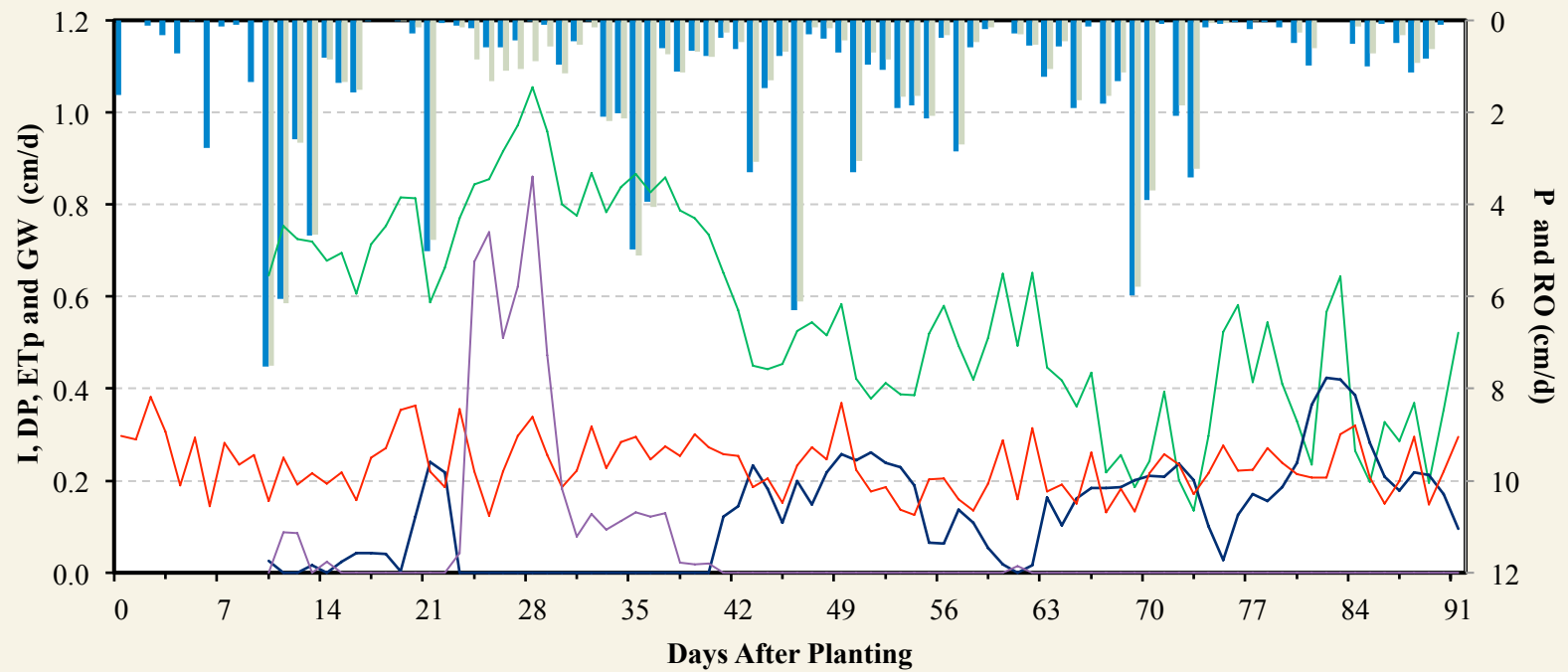


SUCTION HEAD (pF)

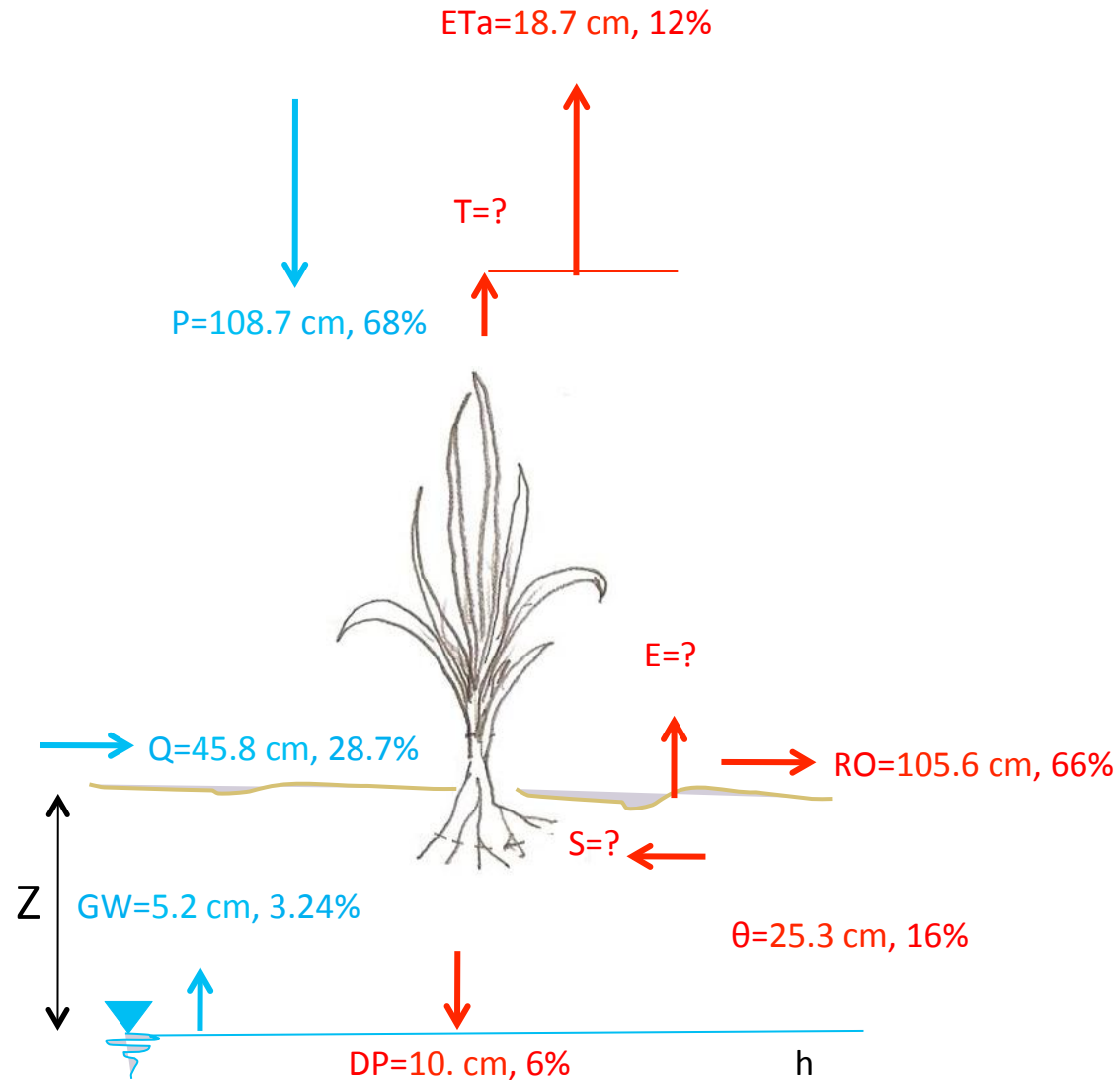


WATER BALANCE

Weather Data 14 Oct 2010-7 13 Jan 2011



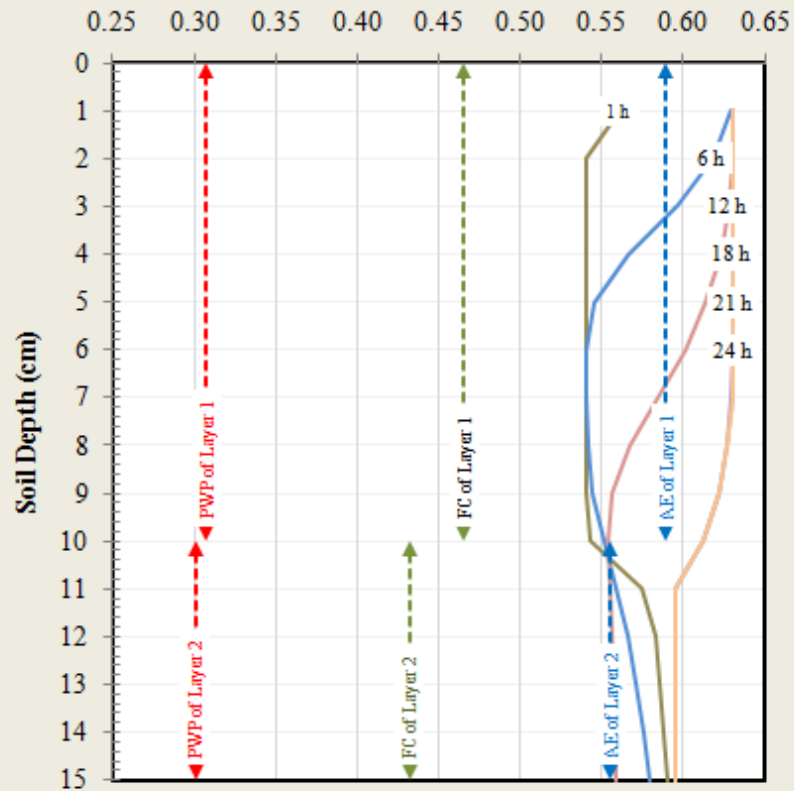
CUMULATIVE WATER BALANCE



MOISTURE PROFILES

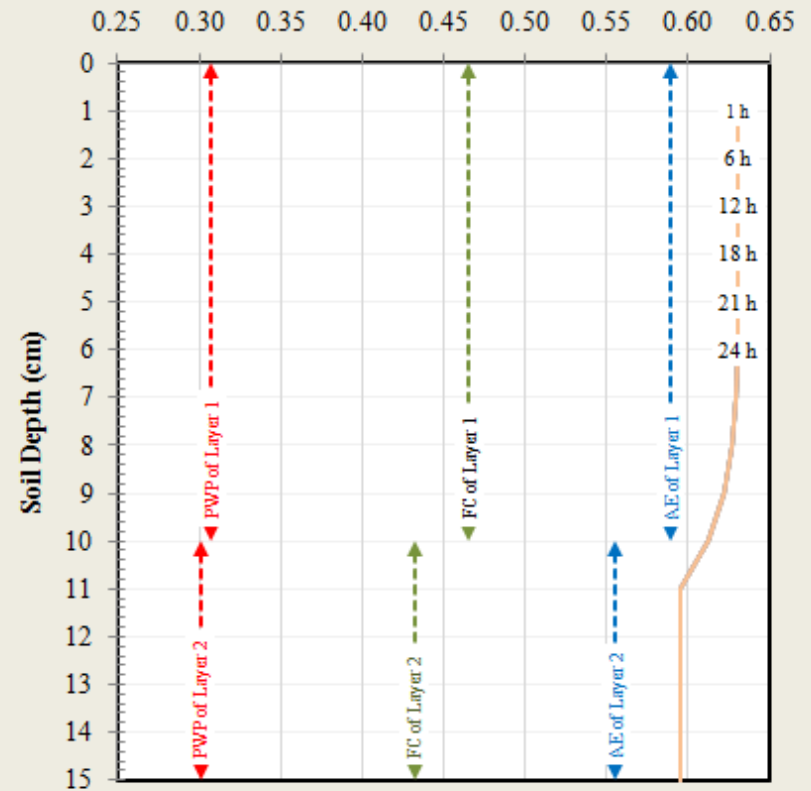
24-Oct-10

Volumetric Water Content (cm^3/cm^3)



25-Oct-10

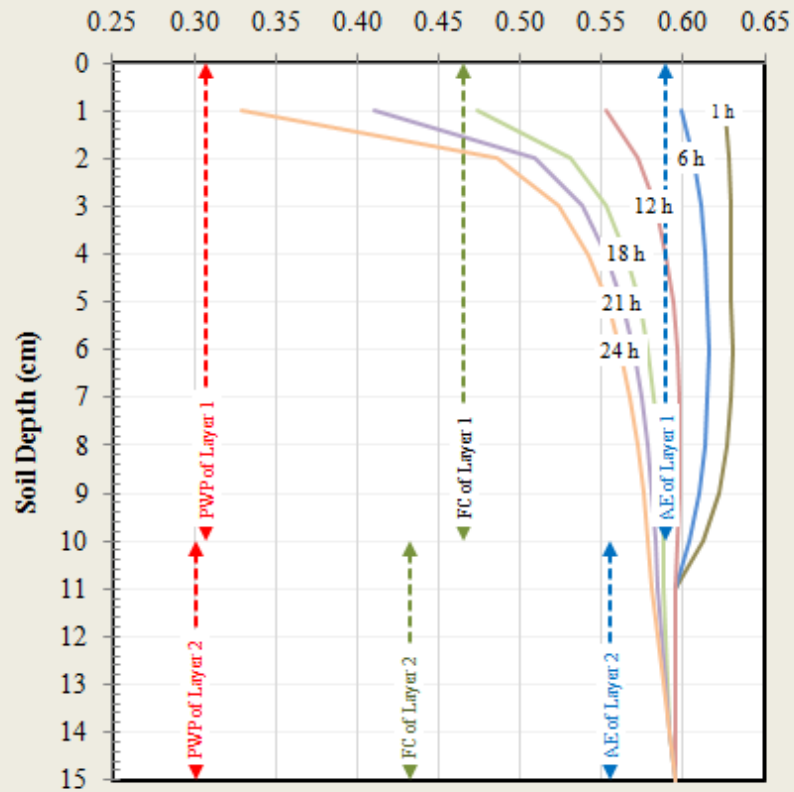
Volumetric Water Content (cm^3/cm^3)



MOISTURE PROFILES

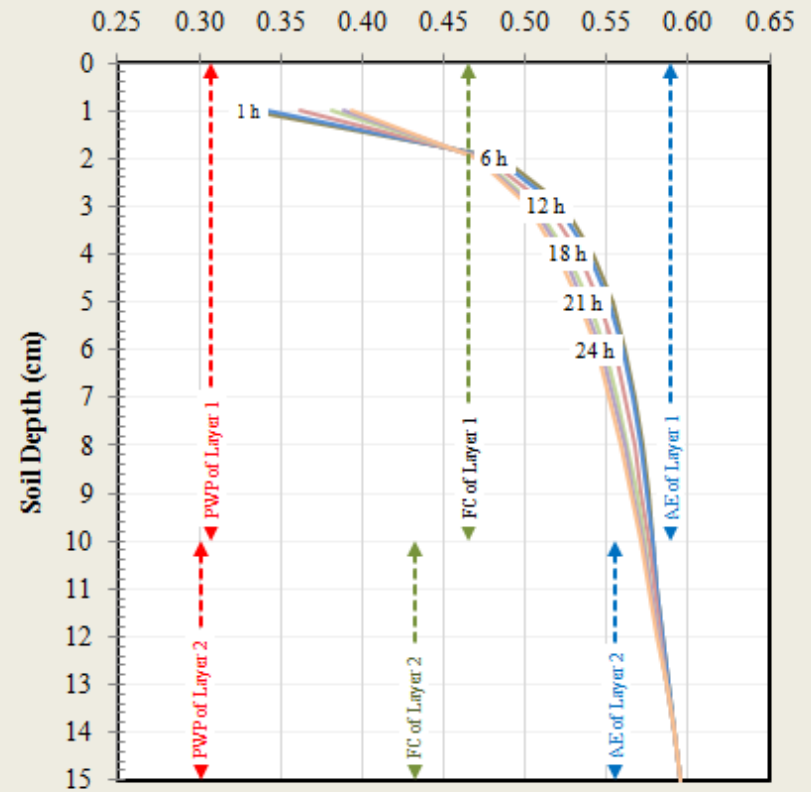
07-Nov-10

Volumetric Water Content (cm^3/cm^3)



08-Nov-10

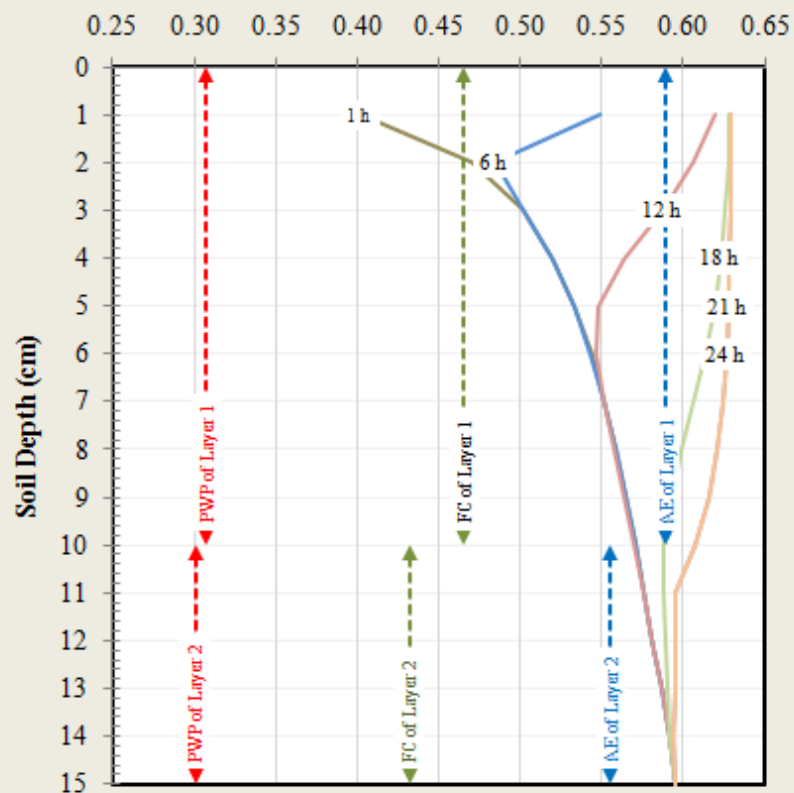
Volumetric Water Content (cm^3/cm^3)



MOISTURE PROFILES

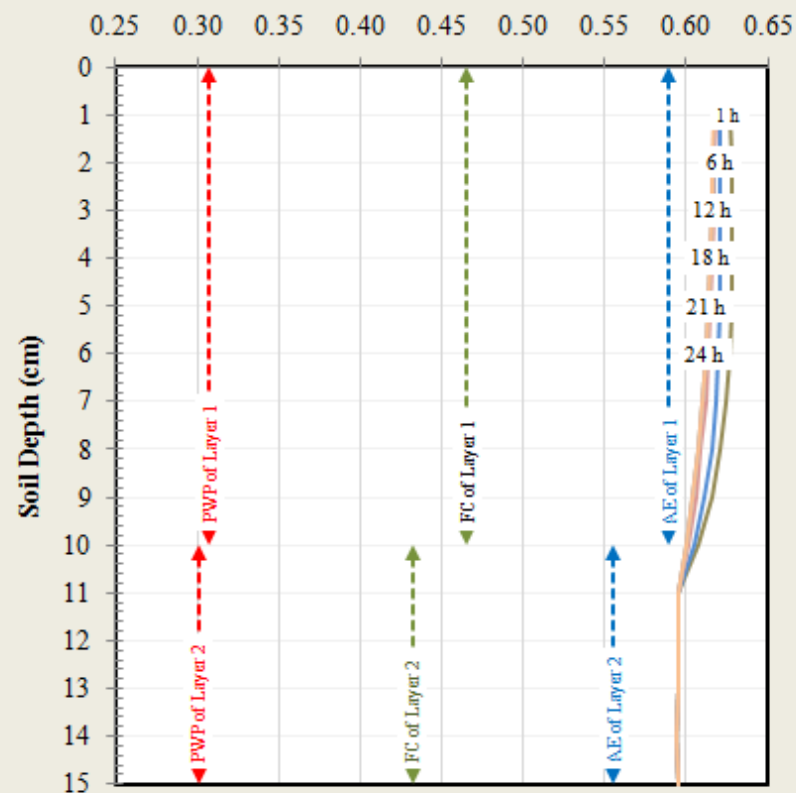
09-Nov-10

Volumetric Water Content (cm^3/cm^3)



10-Nov-10

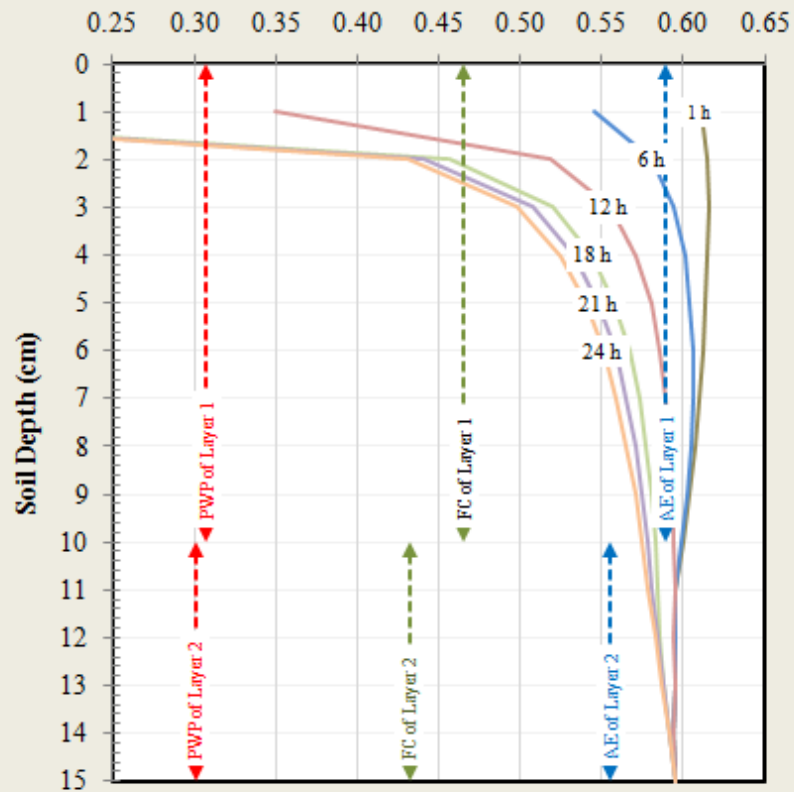
Volumetric Water Content (cm^3/cm^3)



MOISTURE PROFILES

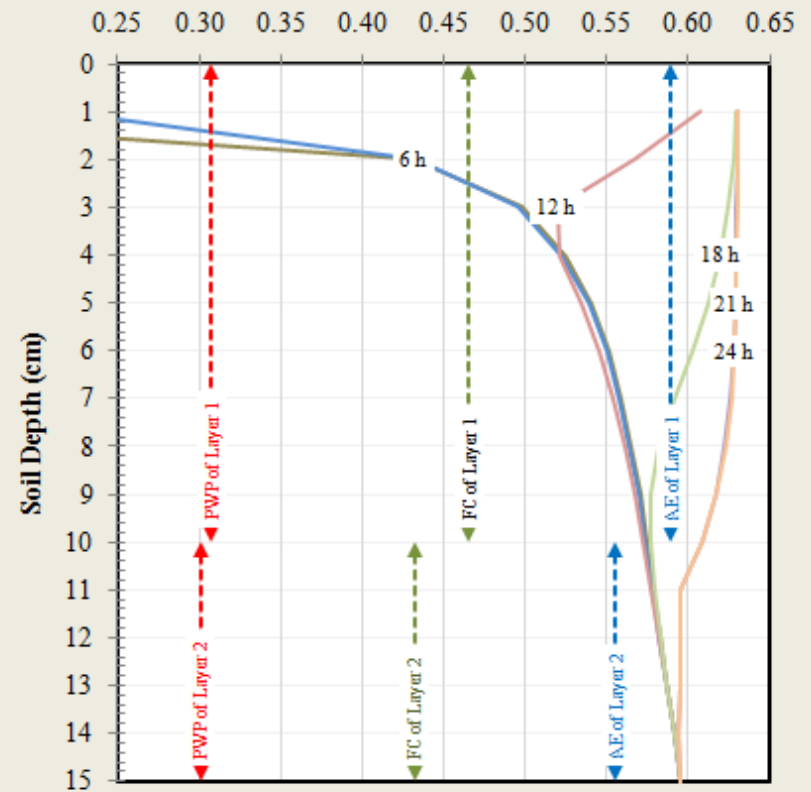
11-Nov-10

Volumetric Water Content (cm^3/cm^3)



12-Nov-10

Volumetric Water Content (cm^3/cm^3)



CONCLUSIONS

Soil moisture was occasionally too dry even though there was enough precipitation.

Runoff was significant component for water losses (66%).

It is necessary to catch rainwater to compensate periods of less available water.

Soil moisture fluctuation was within hourly interval or even less.

Proper water management needs intensive monitoring of micro-climate as well as soil moisture.

Online field sensing can take an important part in giving field data.



THANK YOU FOR YOUR ATTENTION