



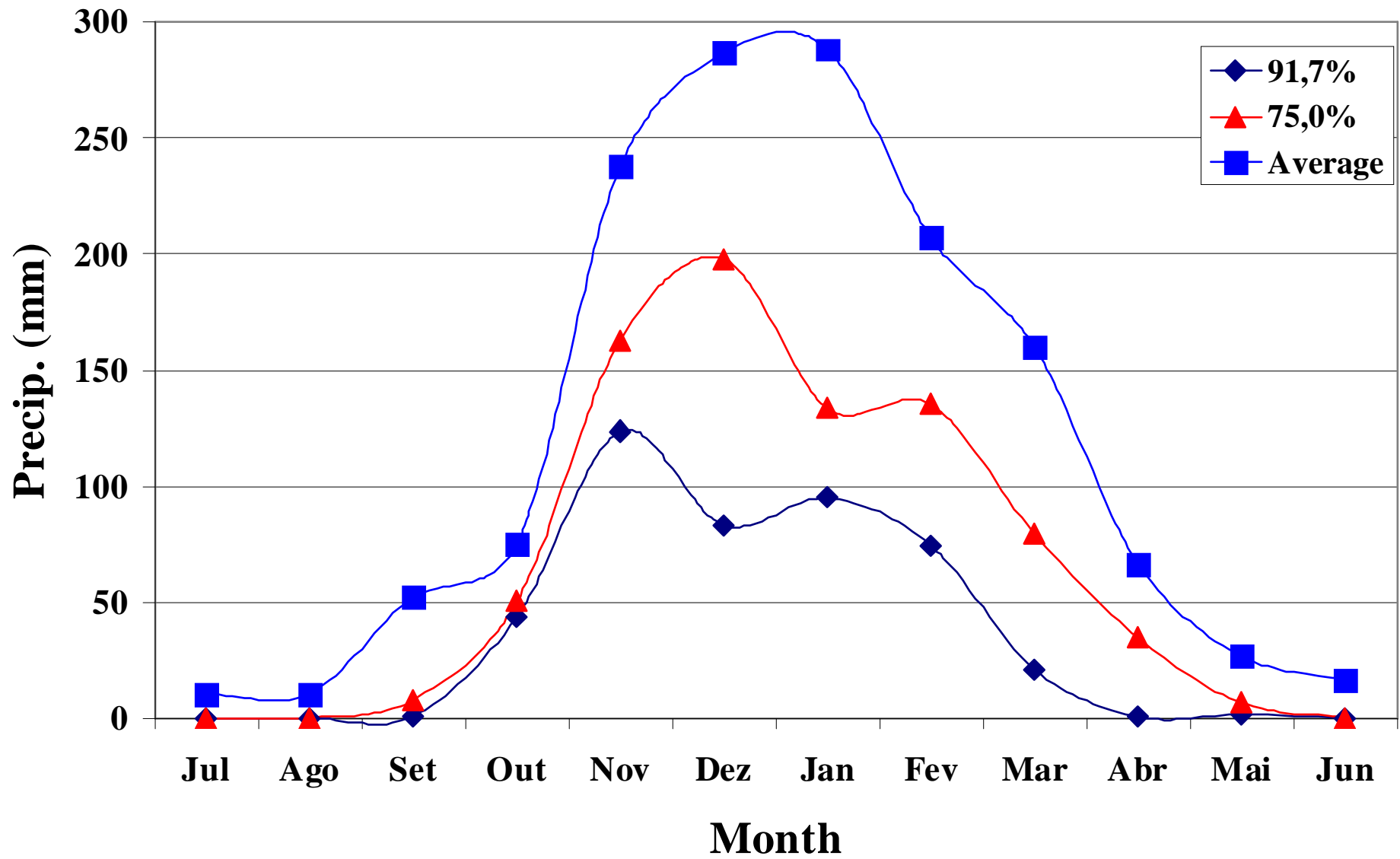
Monitoring Crop Water Stress on Field Trials

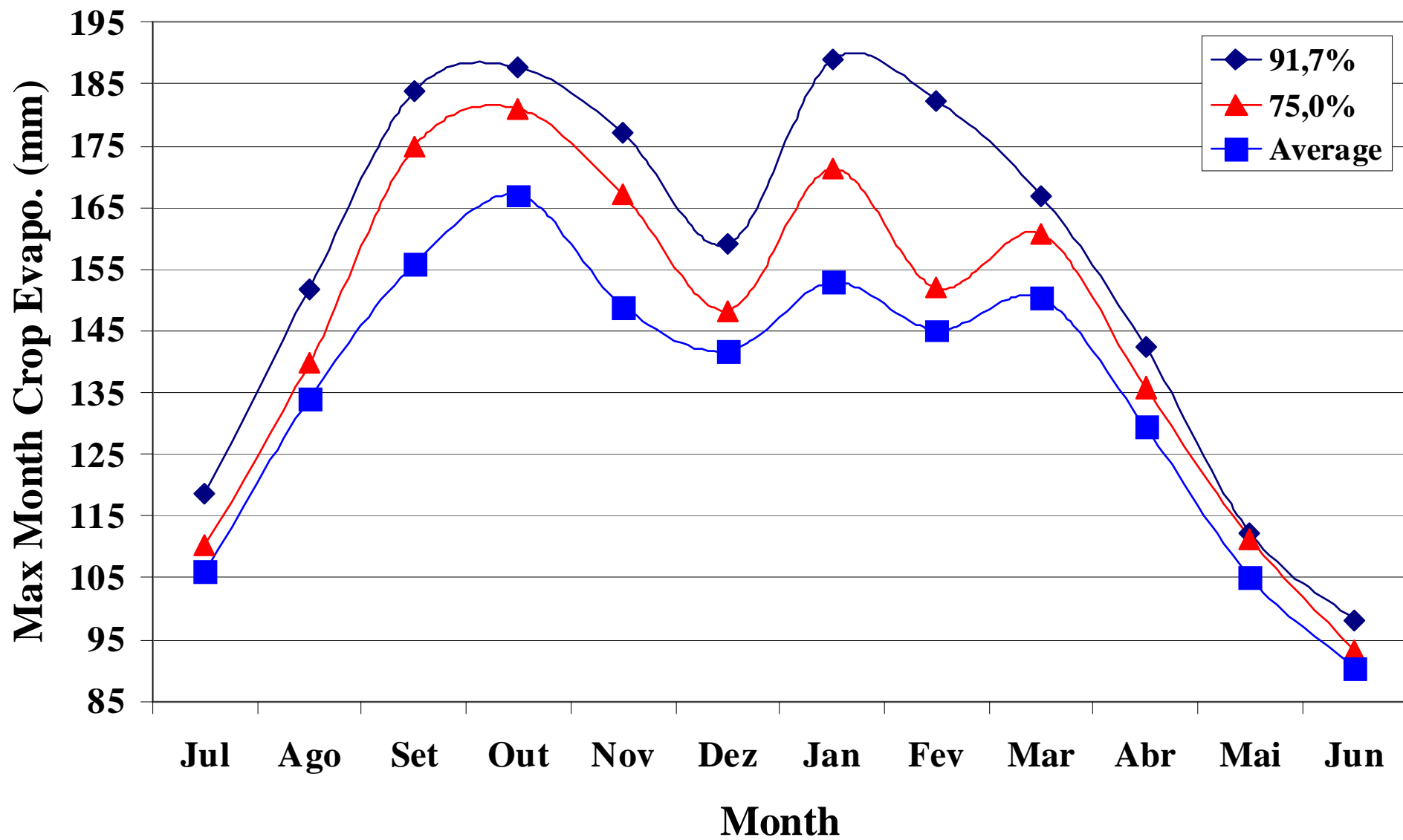
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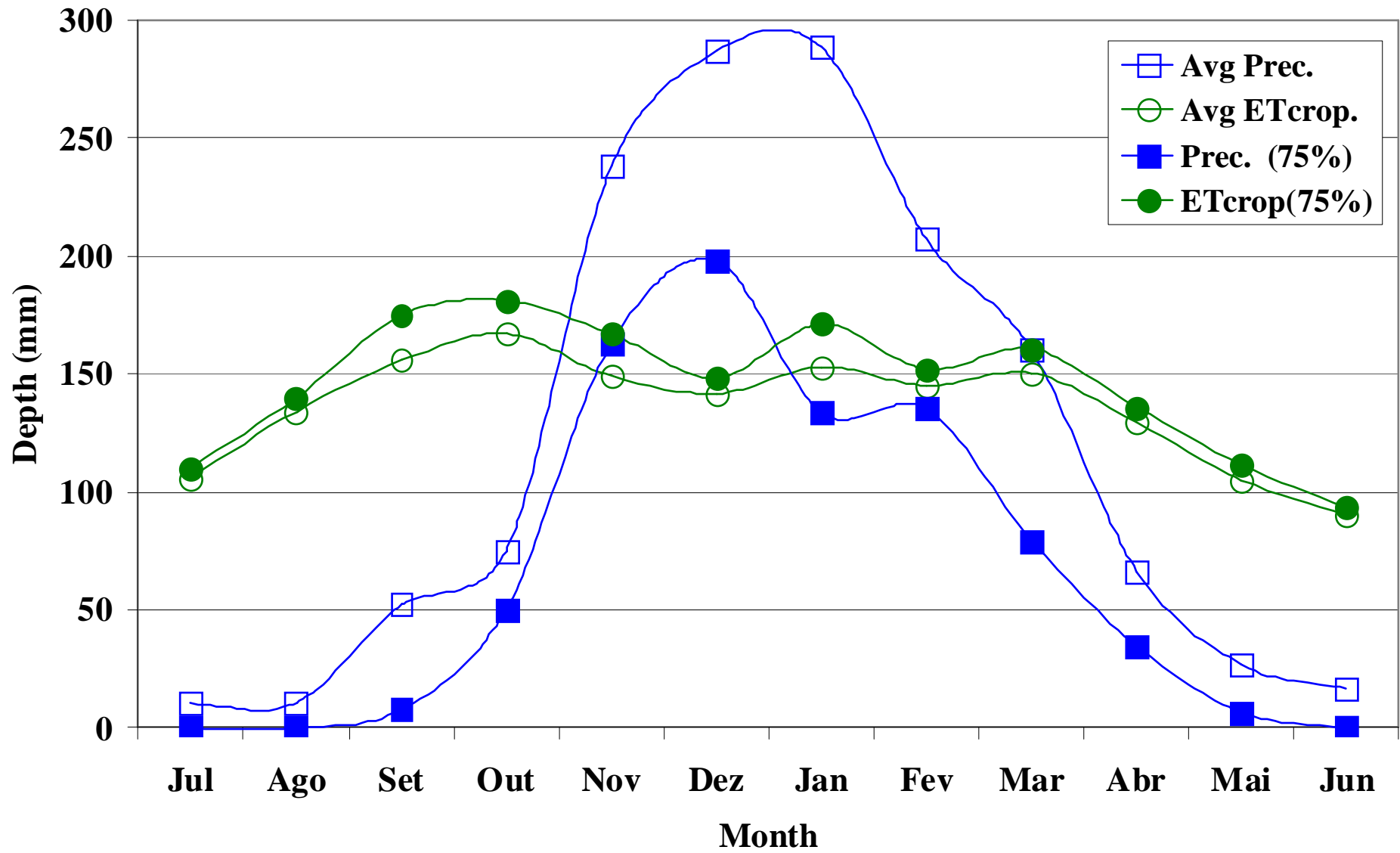
Whole Plant Modeling Project Final Meeting
Iowa, USA - February, 2008

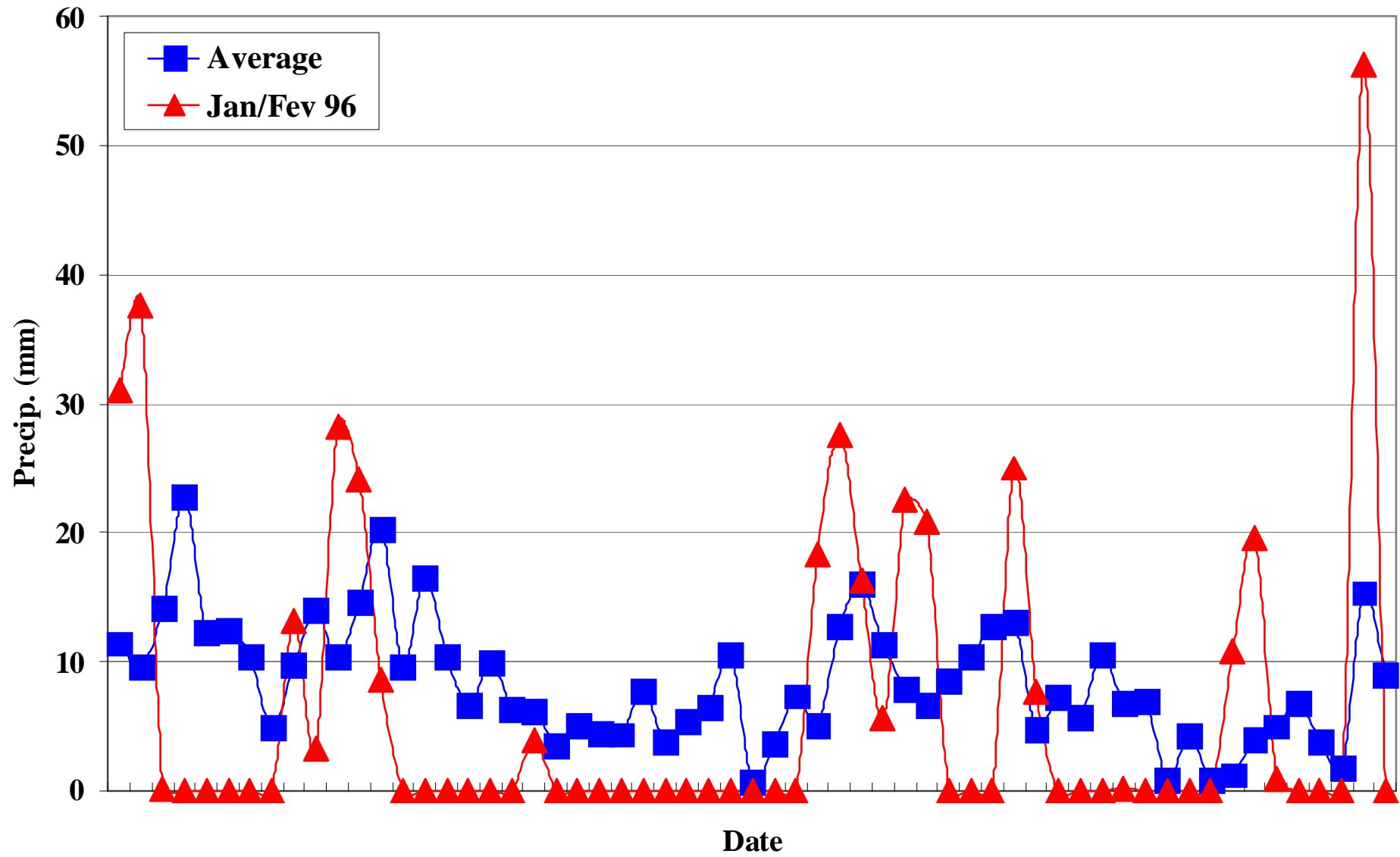


- Central Brazil
- Majority of grain production
- Savanna (Cerrado) ecosystem
- Different cropping systems, two planting seasons: 1st Harvest (rainy) and 2nd Harvest (Safrinha)
- Dry spells: few days up to weeks, great variability among years
- 1st harvest: stress prior or at flowering
- 2nd harvest: stress post-flowering











- **Stress Characterization**
 - **Complex process: Interactions GxE**
 - **Onset, duration, intensity, damage caused to plants**
 - **Single or multiple? H_2O , Al^{+++} , P**
 - **Relationship between stress level and damage**



- **Field trials for water stress studies**
 - Two experiments, one fully irrigated and an identical with water stress
 - Stress control is normally subjective
 - Canopy symptoms like leaf rolling
 - Yield reduction comparisons





- **Monitoring and Controlling Water Stress**
 - **Monitoring**
 - Combination of methods: weather, soil, plants
 - Gravimetric: Cheapest?
 - Sensors manually or automatically recorded
 - Monitoring the plant
 - Cost!
 - **Model or spreadsheet to estimate**
 - Onset, duration, intensity and damage to crop
 - Requires information on weather, soil and crop

			1	2	3				opcional
	Cond. do solo:		Solo Seco	Semi-Úmido	Solo Úmido	2			↓
p:	CC:	36	PMP:	26	d:	1	Ur:	33	<<<< opcional
	fase 1:	0.4	fase 2:	0.5	fase 3:	0.5	fase 4:	0.65	
	CTAD:		1.00	10					

	CLIMA:							
		1	2	3	4			
Dem. Evap.		Baixa	Moderada	Alta	Muito Alta	3	TI da Fase 1:	3
opcional >>>>	Kc (1):			Kc (3):		Kc (5):		<<<<< opcional
	Kp:	1	Kc (1):	0.70	Kc (3):	1.29	Kc (5):	0.35
	decliv1:		0.01616	decliv2:		-0.0328		

	Pivô Central							
T100:	12	L100:	6	P.ponta:	0	T.M.D.:	24	
		Ef:	100	P.pontFS:	0	T.M.D.FS:	24	

AS	ECA ou ETo	Chuva	Recomendação de Irrigar	Lâm. Líquida de Irrigação	Lâmina Bruta de Irrigação	Lâm. de Irrigação Aplicada	Velocidade do pivô (%)	Tempo de funcionamento (horas)	Período de funcionamento (dd : hh : min)	Kc	Chuva Efetiva	Z	R.A.S .D.A. (%)	Fase
0	5.35		* sim	12.0	12.0				: : :	0.70		6.0	70	1
1	5.39		* sim	15.8	15.8				: : :	0.70		6.6	70	1
2	4.95		* sim	16.8	16.8	16.8	36	33.33	1 : 9 : 20	0.70		7.2	15	1
3	4.85		* sim	3.4	NI	8.9	PI > TI	PI > TI	? : ? : ?	0.70		7.7	100	1
4	5.74		* sim	4.0	NI				: : :	0.70		8.3	100	1
5	5.47		* sim	7.8	7.8				: : :	0.70		8.9	52	1
6	5.24		* sim	8.5	8.5	9	#####	#####	# : ## : ##	0.70		9.5	12	1
7	5.05		não	3.5	NI				: : :	0.70		10.1	100	1
8	4.89		* sim	7.0	7.0	8.9	#####	#####	# : ## : ##	0.70		10.6	65	1



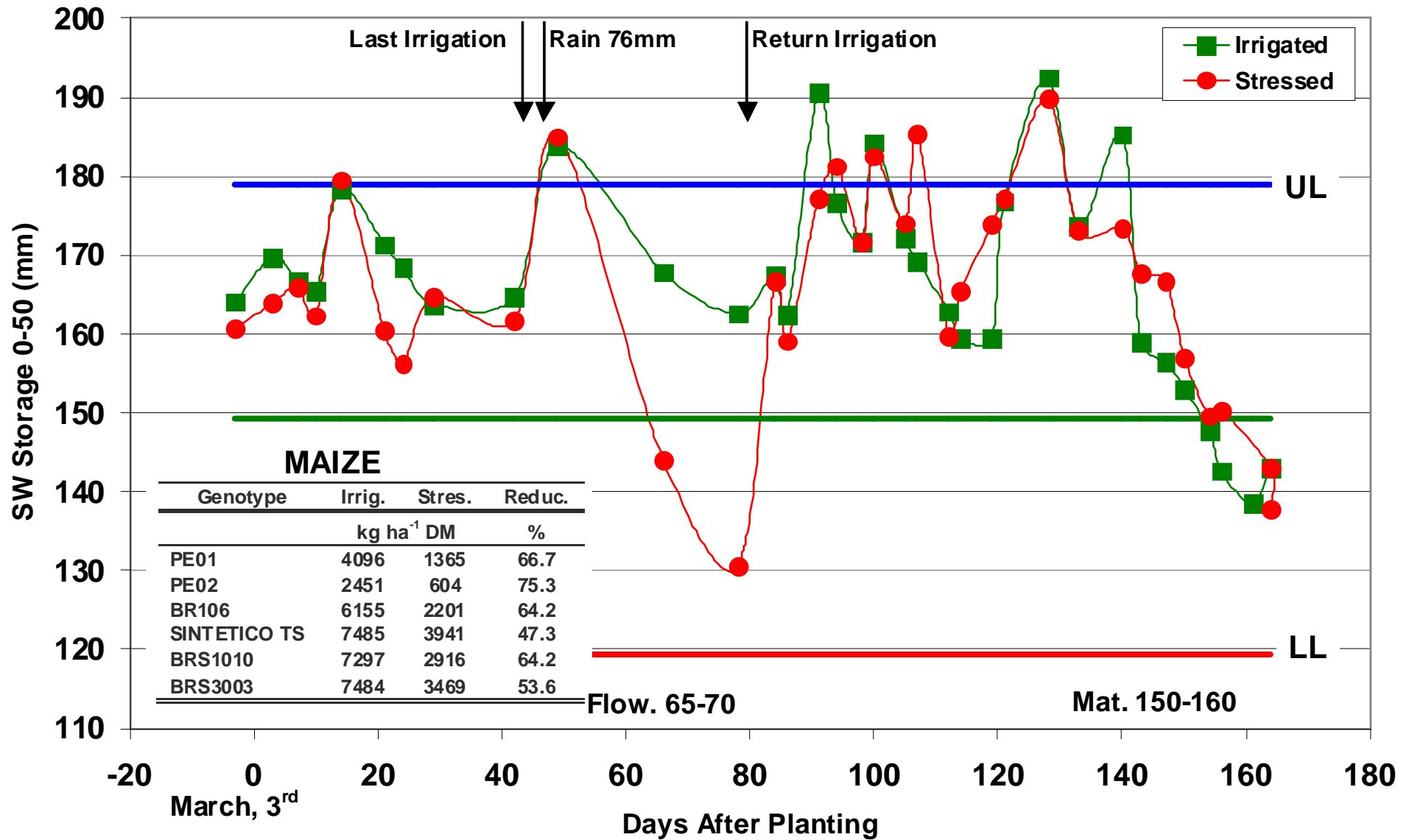
Embrapa
Milho e Sorgo

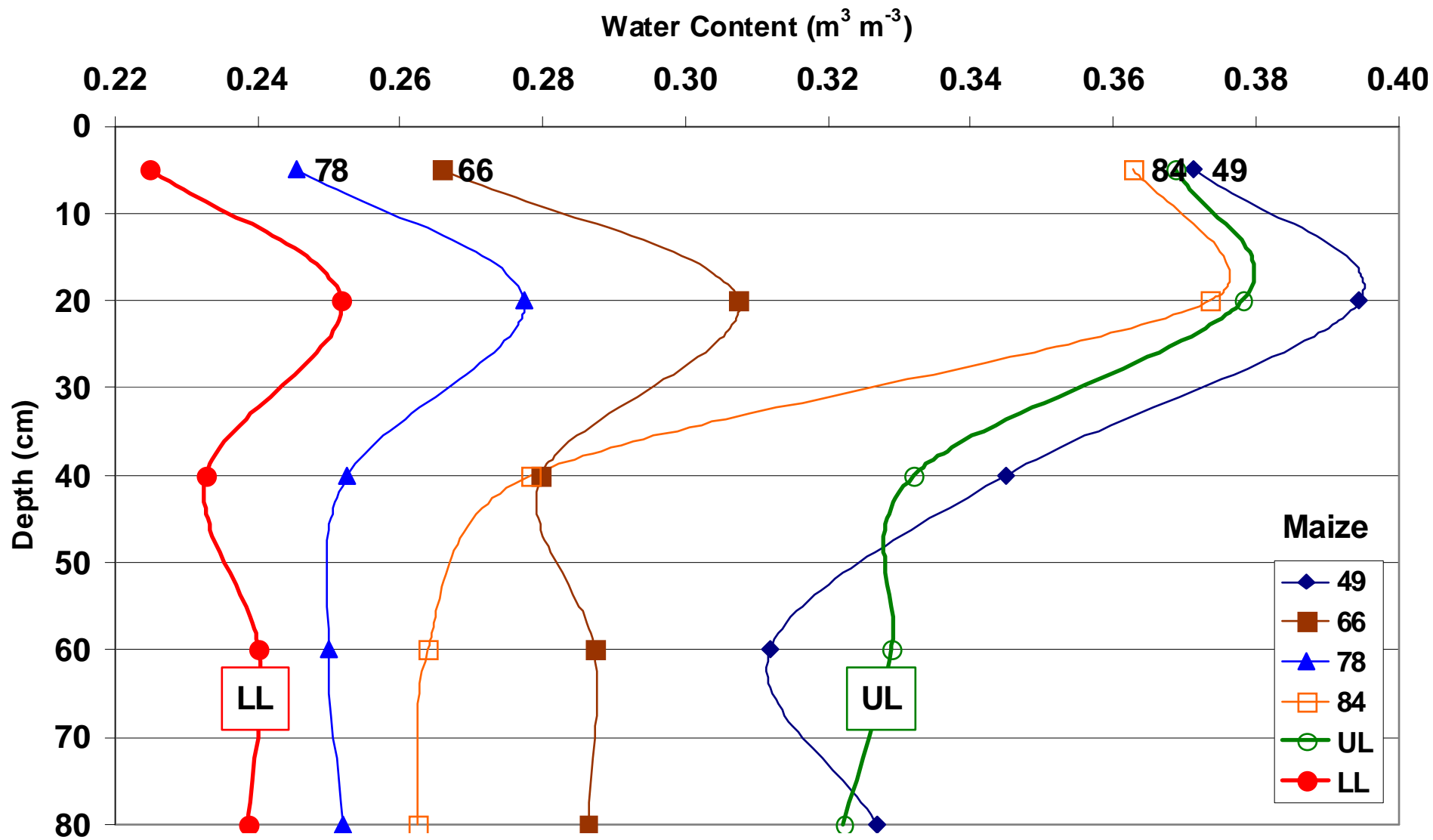


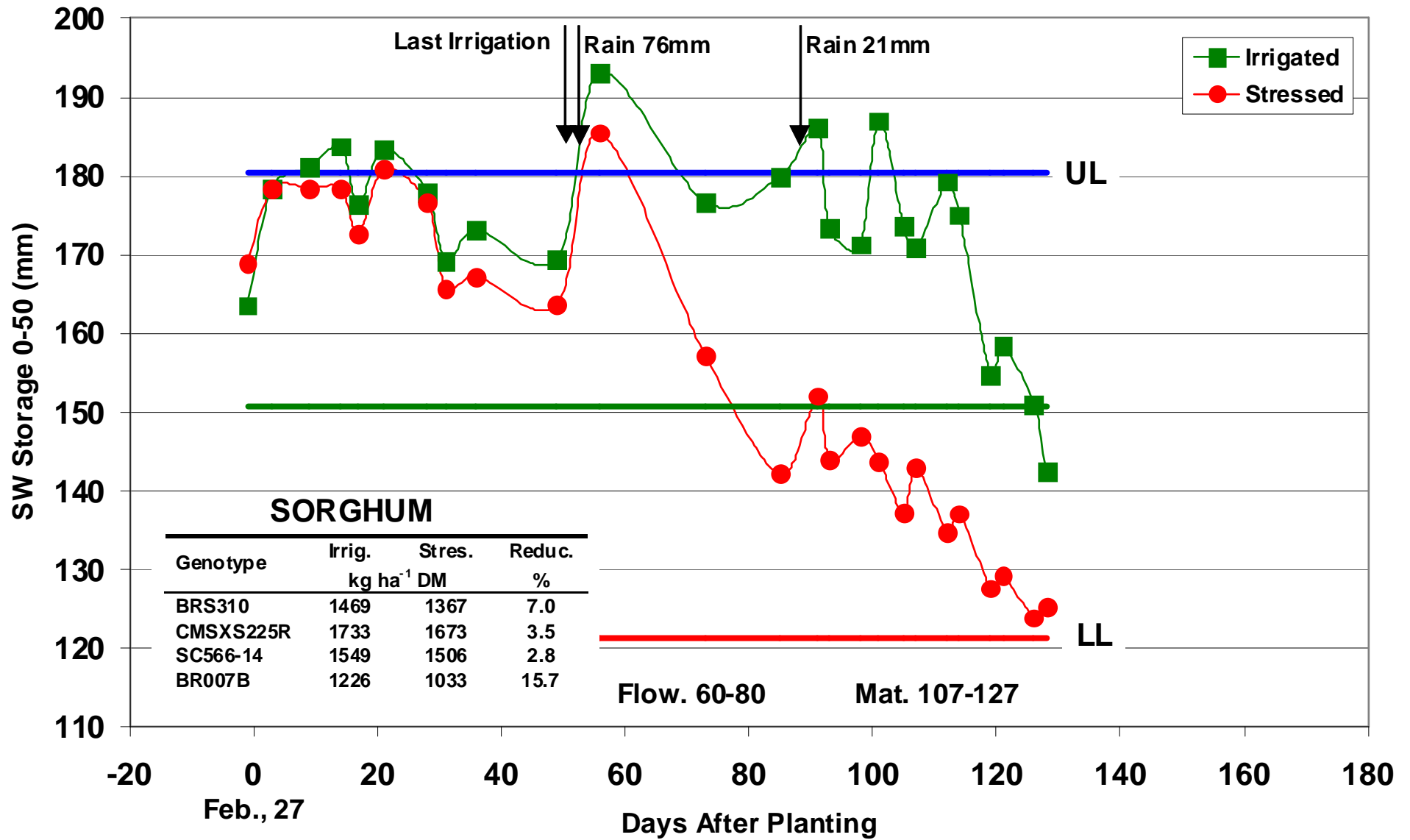


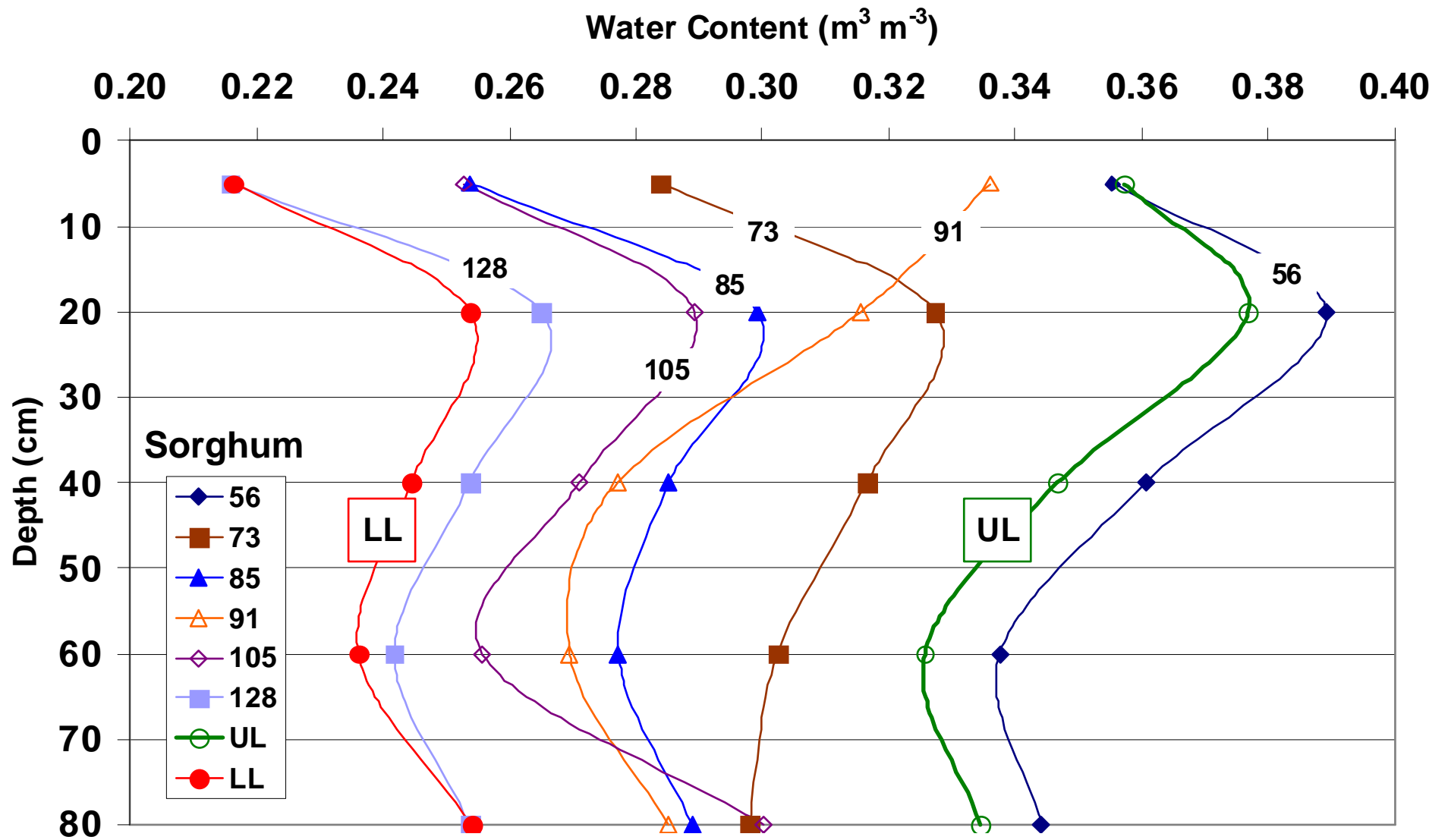


- **Example for Discussion**
 - Data from Sete Lagoas
 - Assumed effective rooting depth of 50 cm
 - Field-determined Upper and Lower Limits of Available Water
 - Gravimetric method to monitor soil-water











- Major Difficulties Faced
 - Preliminary data on soil and crop
 - Field-based soil data
 - Spreadsheet could be used to plan the stress beginning
 - Not effective to define the stress end and the expected damage to crop





- **Major Difficulties Faced**
 - Great number of samples to be processed
 - Strong labor demand
 - Instruments not adequate and not available at the desirable time
 - Augering dry soil (after cutting irrigation) is practically impossible
 - Wind: irrigation uniformity





- **Closing Remarks**

- Methodology need to be refined
- Relationship between stress level and crop damage
- Automation of some data collection
- Rooting system characterization



Thanks!

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