THE EFFECTS ON SOME PHYSIOLOGICAL PROPERTIES OF WATER STRESS ON COTTON

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Drought Stress in Cotton

- Among the abiotic stresses, water stress is perhaps the most yield limiting factor in cultivated crops including cotton.
- Drought stress occur in many different morphological, physiological changes in cotton plants.
- Drought tolerance is complex multi-genic agronomic trait.

Drought Stress in Cotton

- The following traits are used as selection criteria for drought tolerant cotton improvement program

- Modifying root systems (robust root),
- water use efficiency,
- stomatal conductance,
- photosynthetic rate,
- leaf water content,
- canopy temperature (^{o}C),
- initial water content,
- the rate of leaf water loss etc..

Drought Stress in Cotton

- The effect of water stress on yield depends on the timing and severity of the drought.
- the crop growth rate was reduced by water stress through a reduction in size and number of leaves produced and in reduction of photosynthesis (Krieg, 1997).
- Water deficit not only decreases shoot growth rate, plant height, and yield, it also affects root growth.

The Aim of Study

- This study was carried out to determine the changes and taken in precautions to drought stress in cotton plant.

Material and Methods

- The experiment was conducted at the experimental area of the Faculty of Agriculture, Dicle University, with 3 replications according to the split-plot design in 2014-2015 .

- **Main plots** were the amounts of different irrigation water (100%, 80%, 60%, 40%)

- **sub plots** were cotton varieties (Stoneville 453, GW Teks and Deltaopal).

South Eastern Anatolia Project Regon

Material and Method

- Research field is limestone and alluvium material with **C** structure, type of red-brown soil group.
- This type of soil has low organic content (1.45) and has 7.8-7.9% lime in depth of 0-120 cm.
- These field do not have the problem of saltiness and alkaline.

Table 1. Some Physical and Chemical Properties of Experimental Area Soils

Org Subst (%)	1.45
P_2O_5	1.83
K_2O	105.8
PH	7.49
Salt (%)	0.045
Water Saturat. (%)	67
Soil Depth (cm)	0-20
Field Capacity	41.52
Wilting Point	11.88
$CaCo_3$	10.2
Cu (mg/l)	1.31
Mn (mg/l)	13.71
Fe (mg/l)	7.50
Zn (mg/l)	0.34
Sand (%)	14.8
Clay (mg/l)	66.48
Silt (%)	18.72
Soil Structure	Clay

Material and Method

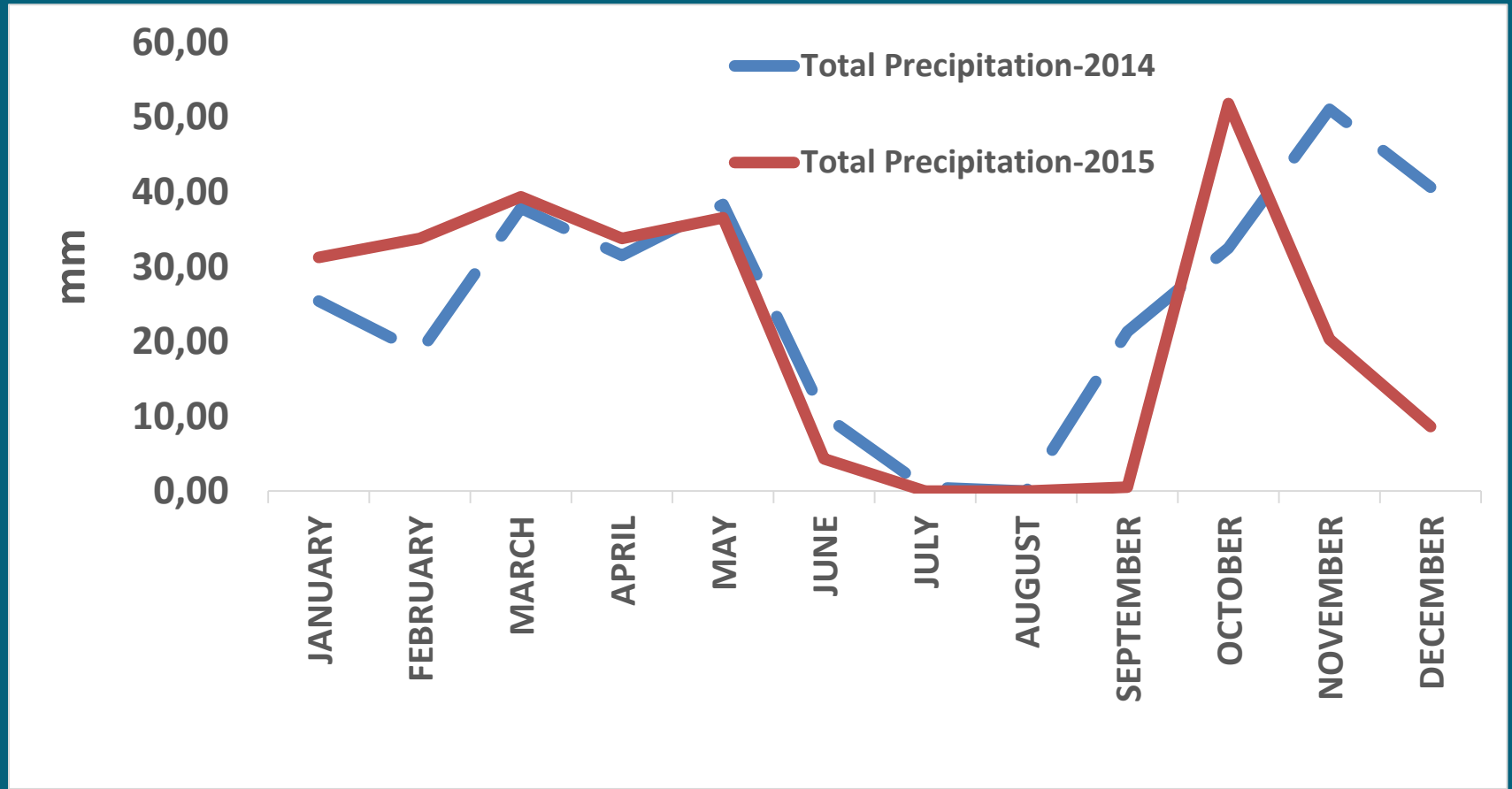
Climate Condaditon

The province of Diyarbakir in terms of climate involved Southeastern Anatolian steppe climate.

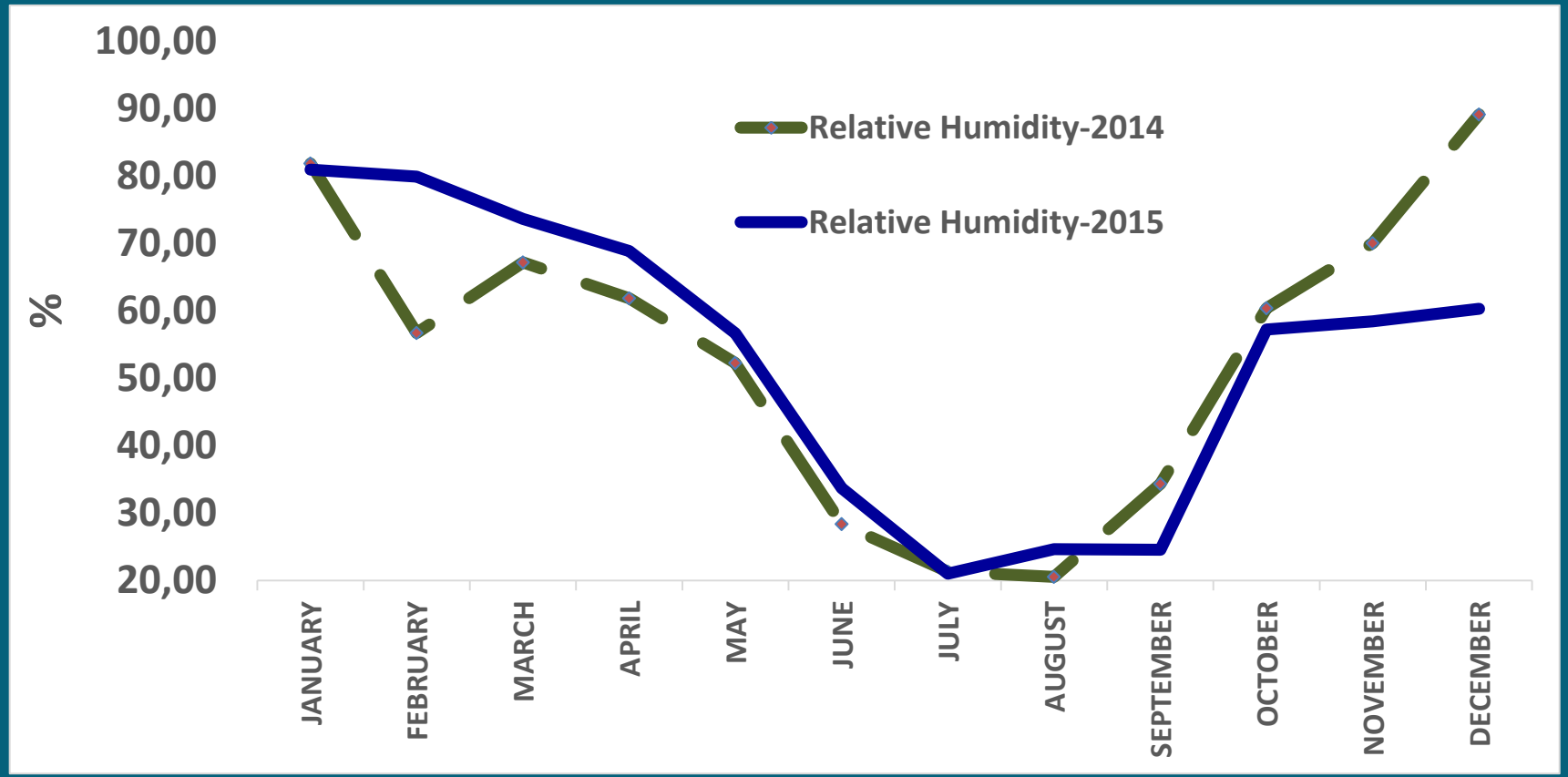
The average annual rainfall is 490 mm, of the rainfall 18%, in autumn, 44% in winter, 37% in spring and 1% in summer months.

The annual average temperature is 15.8 °C, the driest and hottest months are July and August.

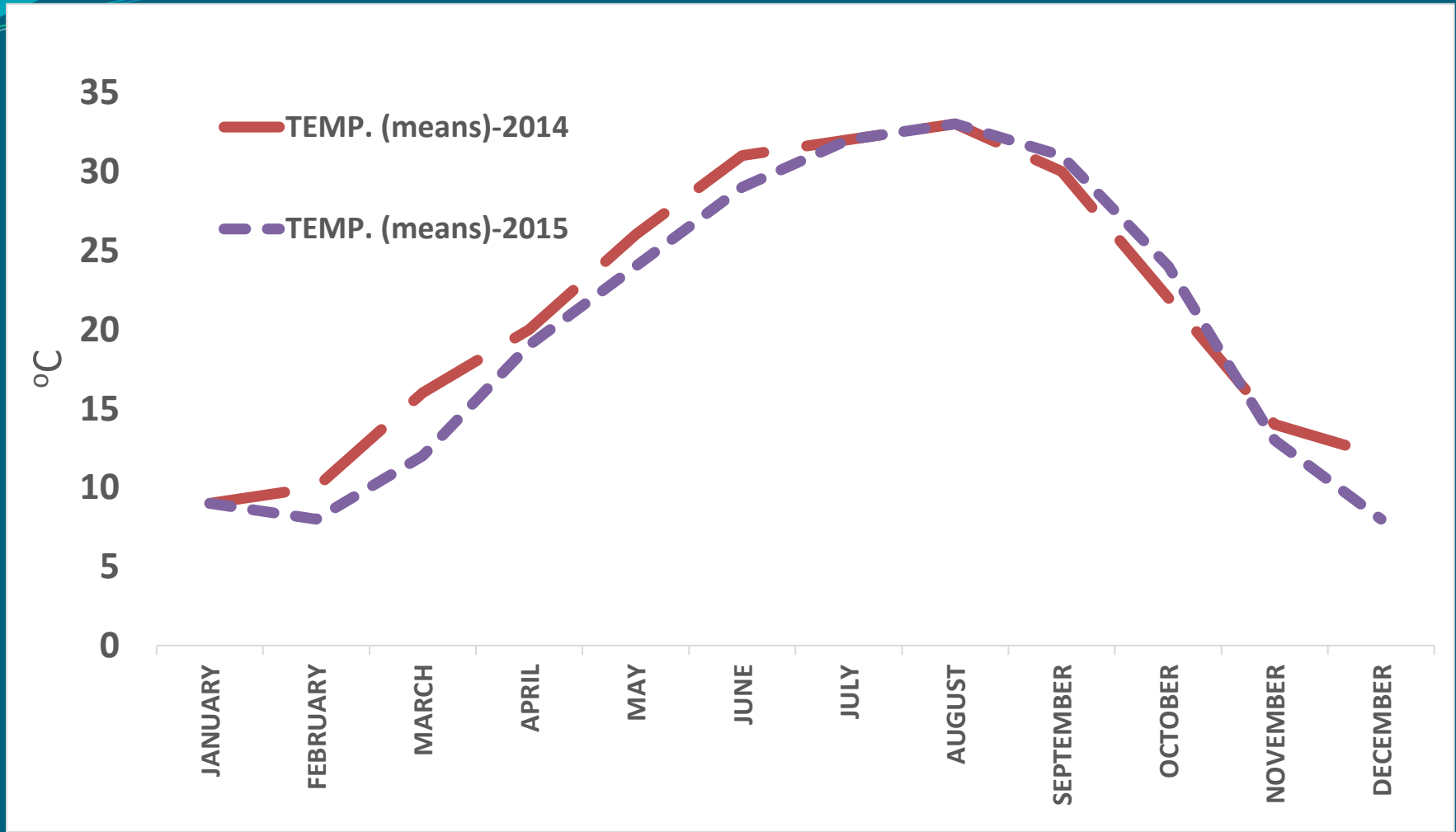
Mountly Average Precipitation (mm)



Mountly Average Humidity (mm)



Mountly Average Temperature (ºC)



Material and Method

- The plots consists of 4 rows and 12 m length and 2m distance between main plots.
- Delta T Profile Probe Tube was placed between the middle 2 rows of each plots in 90 cm depth in order to determine the soil moisture level before the first irrigation.
- were used Drip irrigation.

Material and Methods

In the study determined properties

- ✓ plant height (cm),
- ✓ stem diameter (cm),
- ✓ leaf area index (LAI),
- ✓ leaf temperature (°C),
- ✓ photosynthesis yield (µmol m^{-2} s^{-1}).

Results and Discussion

Varieties and Field Capacity Saturation Degree (FCSD) variation sources were determined statistically significant in terms of

plant height,

root diameter,

leaf area index,

leaf temperature

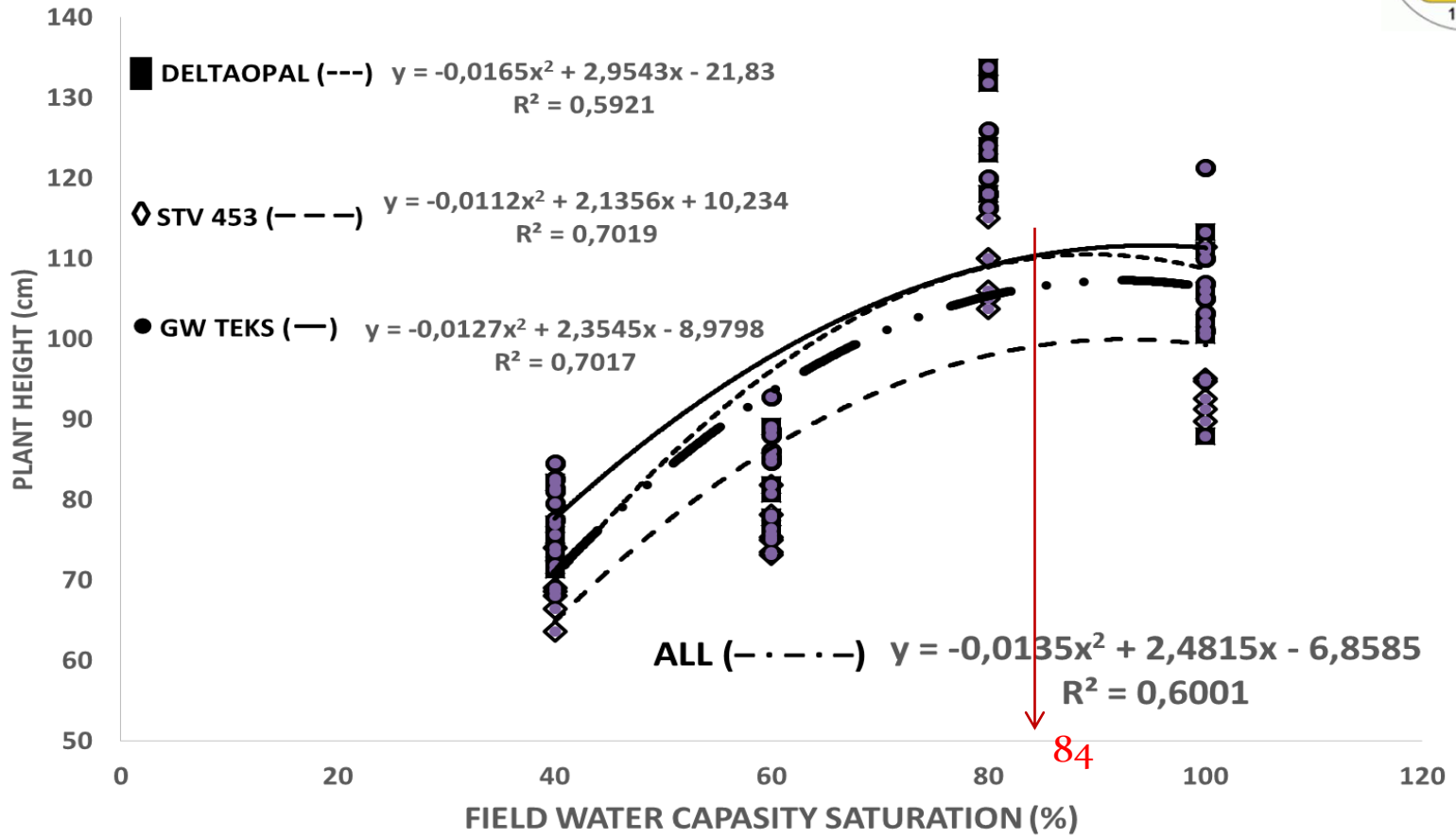
photosynthesis yield characteristics.

Plant Height (cm)

Varieties	FCSD (%)	2014	2015	Means (cm)	
Deltaopal	20%	70,00	70,83	**70,42**	
	40%	73,46	76,98	**75,22**	
	60%	80,11	80,44	**80,28**	
	80%	121,67	127,86	**124,76**	
	100%	102,82	104,05	**103,43**	
Stoneville 453	20%	64,33	64,91	**64,62**	
	40%	67,70	68,88	**68,29**	
	60%	74,60	77,70	**76,15**	
	80%	106,59	110,00	**108,29**	
	100%	93,68	97,90	**95,79**	
GW Teks	20%	76,00	75,47	**75,74**	
	40%	79,45	82,74	**81,09**	
	60%	86,27	88,90	**87,58**	
	80%	120,11	118,67	**119,39**	
	100%	107,27	108,49	**107,88**	
Deltaopal		89,61	92,03	**90,82**	b
Stoneville 453		81,38	83,88	**82,63**	c
GW Teks		93,82	94,85	**94,34**	a
Means	20%	70,11	70,40	**70,26**	e
	40%	73,54	76,20	**74,87**	d
	60%	80,33	82,35	**81,34**	c
	80%	116,12	118,84	**117,48**	a
	100%	101,26	103,48	**102,37**	b
Means		**88,27**	**90,25**	**89,26**	

LSD $_{0.05\ Year}$	NS	**LSD** $_{0.05\ Variety}$	2,59	**
LSD $_{0.05\ Year*Variety}$	NS	**LSD** $_{0.05\ TKDD}$	3.60	**
LSD $_{0.05\ Year*TKDD}$	NS	**LSD** $_{0.05\ Variety*TKDD}$	NS	
LSD $_{0.05\ Variety*TKDD*Year}$	NS	**CV (%)**	6.03	

Plant Height (cm)

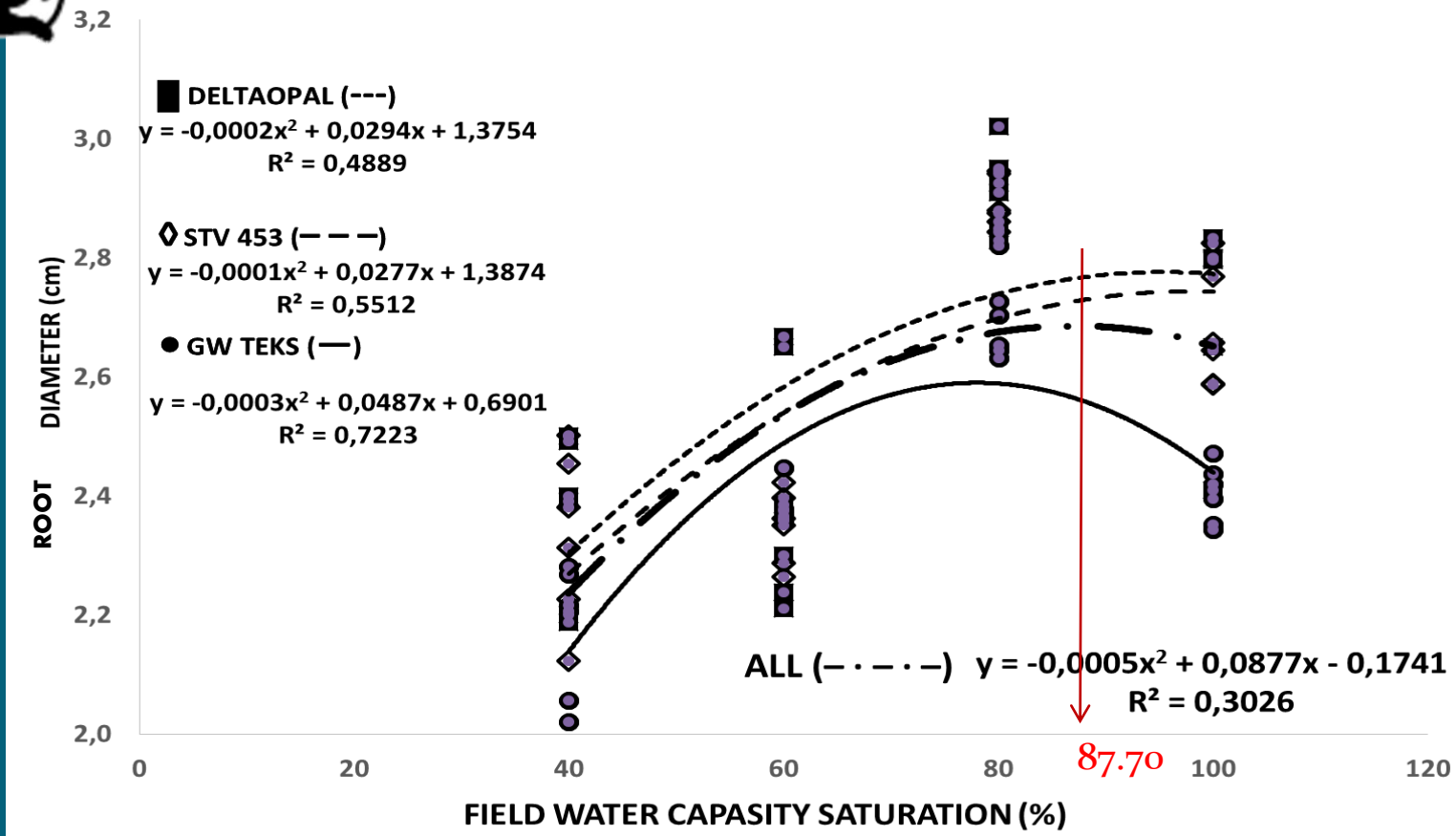


Root Diameter (cm)

Varieties	FCSD (%)	2014	2015	Means (cm)	
Deltaopal	20%	2,35	2,18	**2,27**	gh
	40%	2,64	2,56	**2,60**	fgh
	60%	2,84	2,63	**2,73**	efg
	80%	4,65	4,52	**4,59**	a
	100%	3,38	3,23	**3,30**	bcd
Stoneville 453	20%	2,15	2,03	**2,09**	h
	40%	2,42	2,24	**2,33**	gh
	60%	2,46	2,37	**2,42**	gh
	80%	3,29	3,09	**3,19**	bcde
	100%	3,19	3,07	**3,13**	cdef
GW Teks	20%	2,30	2,07	**2,19**	h
	40%	3,00	2,92	**2,96**	def
	60%	2,99	2,94	**2,97**	def
	80%	3,83	3,43	**3,63**	bc
	100%	3,78	3,62	**3,70**	b
Deltaopal		3,17	3,02	**3,10**	a
Stoneville 453		2,70	2,56	**2,63**	b
GW Teks		3,18	2,99	**3,09**	a
Means	20%	2,27	2,09	**2,18**	d
	40%	2,69	2,57	**2,63**	c
	60%	2,76	2,65	**2,71**	c
	80%	3,92	3,68	**3,80**	a
	100%	3,45	3,30	**3,38**	b
Means		**3,02**	**2,86**	**2,94**	

LSD 0.05 Year	NS	**LSD** 0.05 Variety	0,23	**
LSD 0.05 Year*Variety	NS	**LSD** 0.05 TKDD	0.31	**
LSD 0.05 Year*TKDD	NS	**LSD** 0.05 Variety*TKDD	0,53	**
LSD 0.05 Variety*TKDD*Year	NS	**CV (%)**	15.63	

Root Diameter (cm)

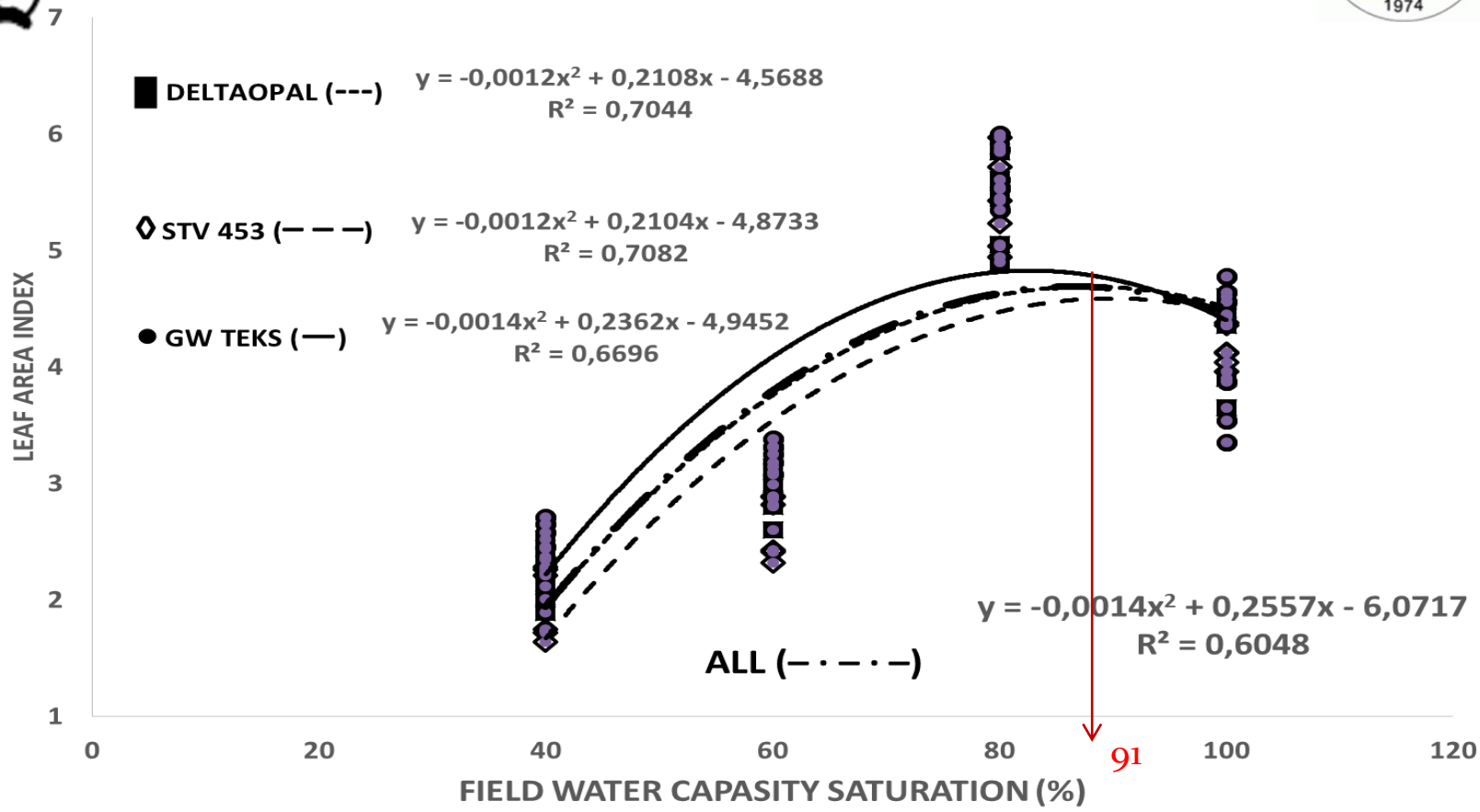


Leaf area index (LAI)

Varieties	FCSD (%)	2014	2015	Means	
Deltaopal	20%	2,33	1,82	**2,08**	
	40%	2,44	2,01	**2,22**	
	60%	3,08	2,76	**2,92**	
	80%	5,79	7,87	**6,83**	
	100%	4,46	5,13	**4,80**	
Stoneville 453	20%	2,14	1,54	**1,84**	
	40%	2,25	1,70	**1,98**	
	60%	2,86	2,39	**2,62**	
	80%	5,07	6,04	**5,56**	
	100%	4,07	4,26	**4,17**	
GW Teks	20%	2,53	2,15	**2,34**	
	40%	2,65	2,35	**2,50**	
	60%	3,31	3,19	**3,25**	
	80%	5,71	7,68	**6,69**	
	100%	4,66	5,59	**5,12**	
Deltaopal		3,62	3,92	**3,77**	**b**
Stoneville 453		3,28	3,19	**3,23**	**c**
GW Teks		3,77	4,19	**3,98**	**a**
Means	20%	2,33	1,84	**2,08**	e
	40%	2,45	2,02	**2,23**	**d**
	60%	3,08	2,78	**2,93**	**c**
	80%	5,52	7,20	**6,36**	**a**
	100%	4,40	4,99	**4,70**	b
Means		**3,56 b**	**3,76 a**	**3,66**	

LSD $_{0.05\ Year}$	0.038 **	**LSD** $_{0.05\ Variety}$	0,046 **
LSD $_{0.05\ Year*Variety}$	NS	**LSD** $_{0.05\ TKDD}$	0.145 **
LSD $_{0.05\ Year*TKDD}$	NS	**LSD** $_{0.05\ Variety*TKDD}$	NS
LSD $_{0.05\ Variety*TKDD*Year}$	NS	**CV (%)**	5.90

Leaf area index (LAI)

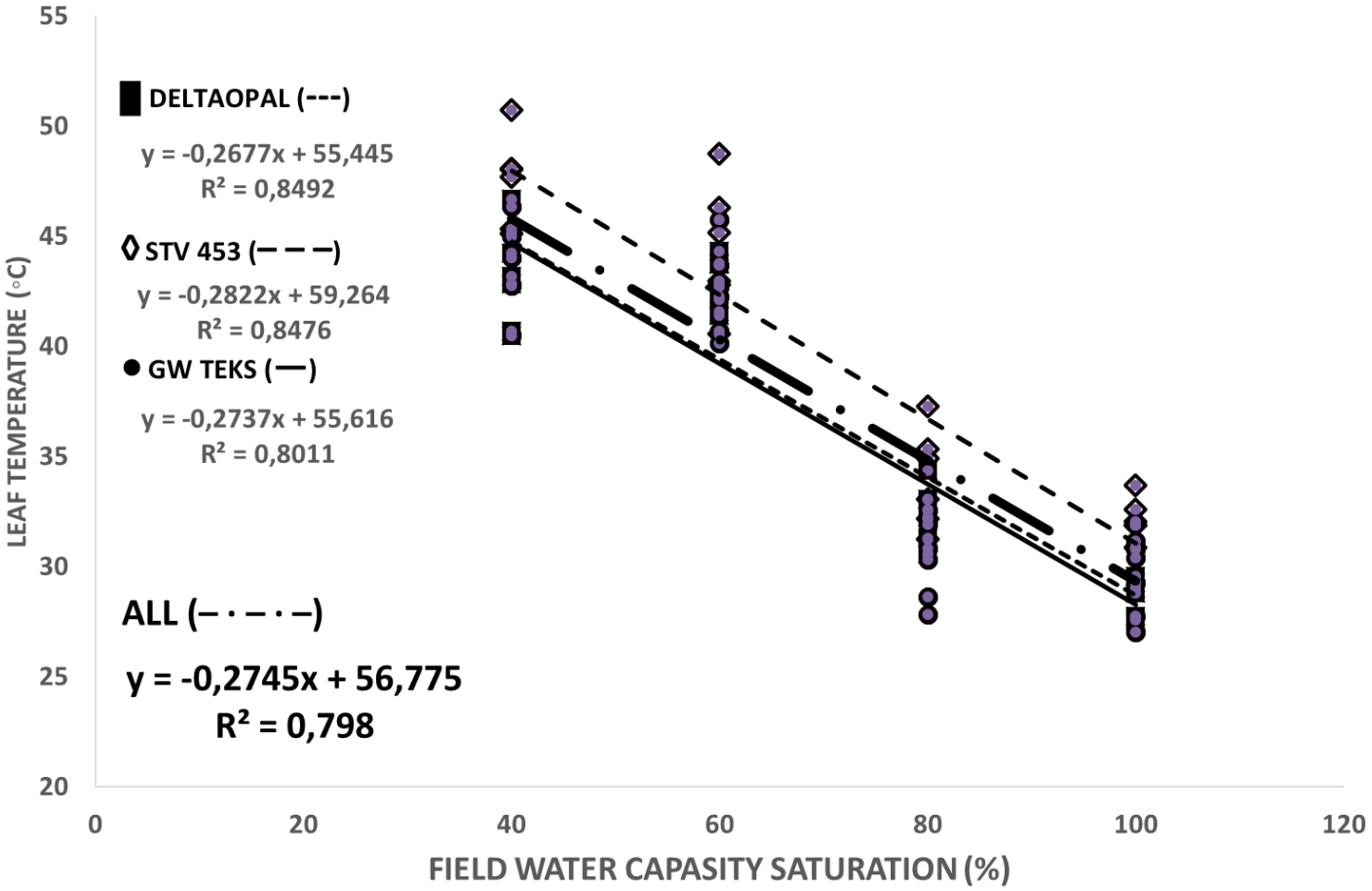


Leaf Temperature (°C)

Varieties	FCSD (%)	2014	2015	Means (°C)
Deltaopal	20%	48,14	45,12	**46,63**
	40%	44,23	41,79	**43,01**
	60%	43,94	41,70	**42,82**
	80%	33,22	31,47	**32,34**
	100%	29,03	28,28	**28,66**
Stoneville 453	20%	46,65	44,30	**45,47**
	40%	44,70	42,45	**43,57**
	60%	43,57	41,49	**42,53**
	80%	31,03	29,64	**30,33**
	100%	29,15	29,63	**29,39**
GW Teks	20%	48,69	46,86	**47,78**
	40%	48,81	46,17	**47,49**
	60%	45,61	43,21	**44,41**
	80%	34,78	33,19	**33,98**
	100%	32,72	31,58	**32,15**
Deltaopal		39,71	37,67	**38,69** b
Stoneville 453		42,12	40,20	**38,26** b
GW Teks		39,02	37,50	**41,16** a
Means	20%	47,83	45,43	**46,63 a**
	40%	45,91	43,47	**44,69 b**
	60%	44,37	42,13	**43,25 c**
	80%	33,01	31,43	**32,22 d**
	100%	30,30	29,83	**30,06 e**
Means		**40,28 a**	**38,46 b**	**39,37**

LSD 0.05 Year	0.44 **	**LSD** 0.05 Variety	0,54 **
LSD 0.05 Year*Variety	NS	**LSD** 0.05 TKDD	1.33 **
LSD 0.05 Year*TKDD	NS	**LSD** 0.05 Variety*TKDD	NS
LSD 0.05 Variety*TKDD*Year	NS	**CV (%)**	5.06

Leaf Temperature (°C)

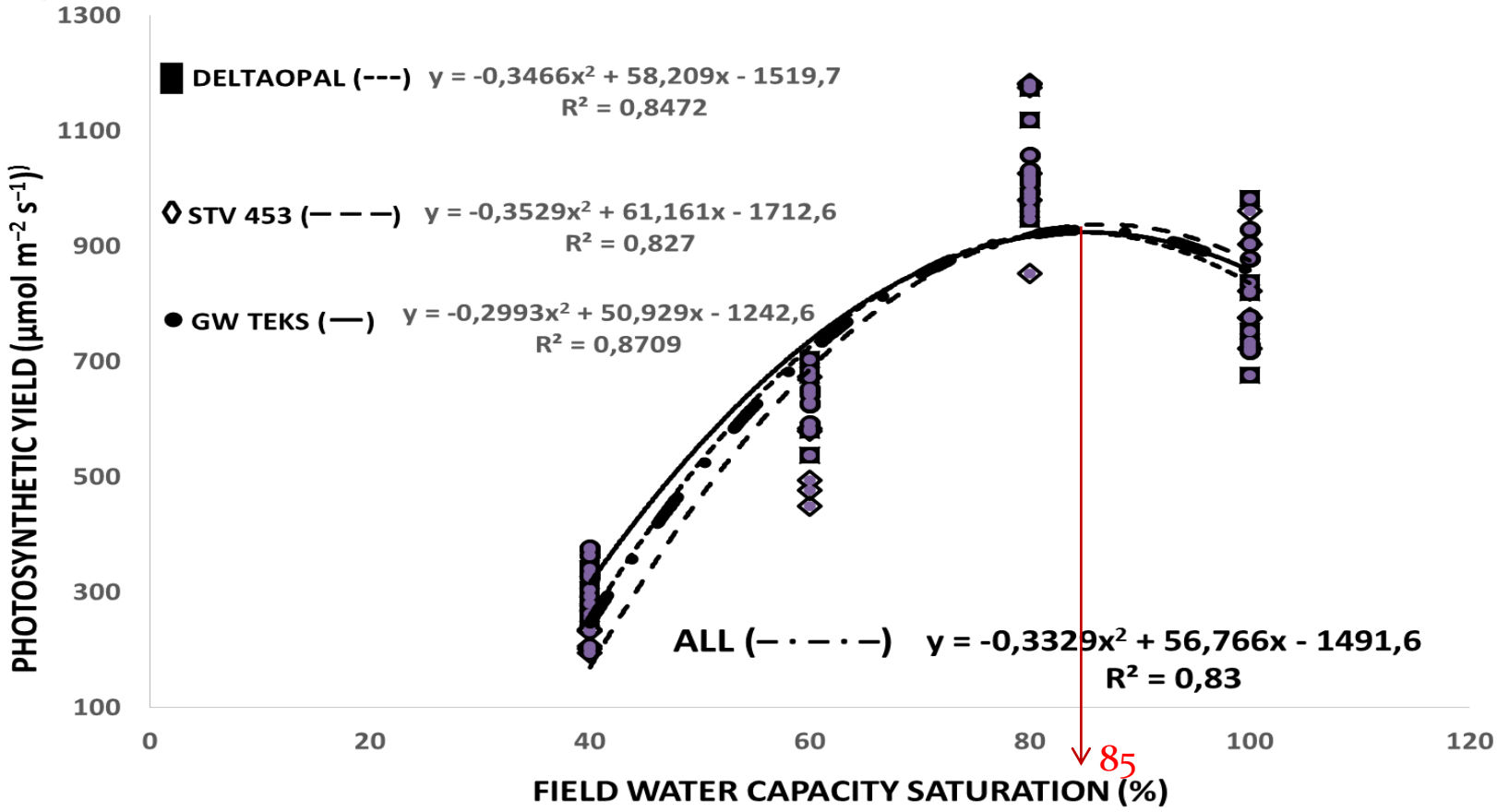


Photosynthesis Yield (µmol m^{-2} s^{-1}).

arieties	FCSD (%)	2014	2015	Means (µmol m^{-2} s^{-1})
Deltaopal	20%	278,16	257,51	**267,83**
	40%	281,94	296,59	**289,26**
	60%	551,80	687,35	**619,58**
	80%	1079,21	969,35	**1024,28**
	100%	720,78	879,29	**800,03**
Stoneville 453	20%	218,58	185,12	**201,85**
	40%	224,23	210,17	**217,20**
	60%	473,32	612,22	**542,77**
	80%	952,24	1279,46	**1115,85**
	100%	758,26	895,41	**826,84**
GW Teks	20%	270,53	267,44	**268,98**
	40%	329,54	371,54	**350,54**
	60%	635,33	627,42	**631,37**
	80%	1026,76	1014,78	**1020,77**
	100%	741,28	904,26	**822,77**
Deltaopal		582,38	618,02	**600,20**
Stoneville 453		525,33	636,48	**580,90**
GW Teks		600,69	637,09	**618,89**
Means	20%	255,76	236,69	**246,22 d**
	40%	278,57	292,77	**285,67 d**
	60%	553,48	642,33	**597,91 c**
	80%	1019,40	1087,86	**1053,63 a**
	100%	740,11	892,99	**816,55 b**
Means		**569,46 b**	**630,53 a**	**599,99**

LSD $_{0.05\ Year}$	26,60 **	**LSD** $_{0.05\ Variety}$	NS
LSD $_{0.05\ Year*Variety}$	NS	**LSD** $_{0.05\ TKDD}$	47.88 **
LSD $_{0.05\ Year*TKDD}$	NS	**LSD** $_{0.05\ Variety*TKDD}$	NS
LSD $_{0.05\ Variety*TKDD*Year}$	NS	**CV (%)**	11,92

Photosynthesis Yield (µmol m^{-2} s^{-1}).



Conclusion

It has been determined there is a quatratic relationship between drought stress and plant height, root diameter, leaf area index, photosynthesis yield,

linear relationship between water stress and leaf temperature properties.

Results and Discussion

The optimum FCSD

for the **plant height property** was **84%,**

root diameter was **87%,**

leaf area index property was **91%,**

photosynthesis property was 85%.


THANK YOU