

# Effects of drought stress on changes in morphology and expression of selected genes in tobacco

Marcin Przybyś

## Aim

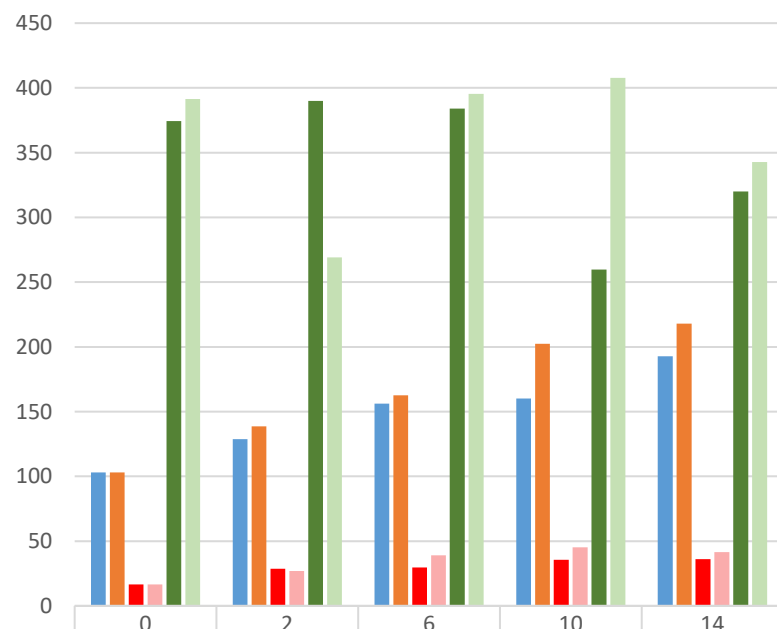
- Understanding the basic mechanisms of tolerance of tobacco plants to drought stress
- Determination of the impact of drought stress on selected morphological and physiological parameters (height of tested plants, leaf surface area, leaf greenness index SPAD)
- Determination of the activity of genes: AREB1, DREB2, NAC1 and WRKY coding transcription factors involved in the plant response to drought conditions, the tested tobacco varieties were assessed for tolerance to drought stress

## Materials and Methods

- 17 tobacco genotypes (Virginia, Burley, oriental)
- experiments in climatic chambers under controlled conditions of 22 °C/18 °C, 16/8 hours photoperiod and 50 % relative air humidity, carried out using the completely randomized block method in 3 replications
  - determination of the leaf area
  - determination of plant height
  - determination of the SPAD index
- qPCR to determine the expression of AREB1, DREB2, NAC1, WRKY genes involved in the plant response to drought stress

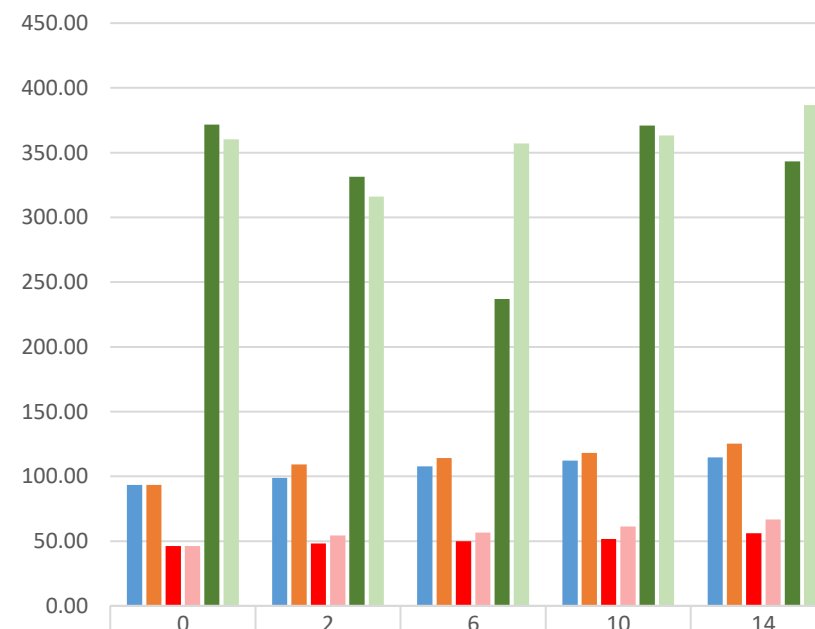
# Results – plant height

HYV 28



	0	2	6	10	14
Leaf area [cm2]	103	128.83	156.17	160.08	192.68
Leaf area control [cm2]	103.16	138.6	162.55	202.34	218.04
Height [cm]	16.7	28.7	29.7	35.7	36.0
Height control [cm]	16.7	27.0	39.0	45.3	41.7
SPAD	374	390	384	260	320
SPAD control	391	269	396	408	343

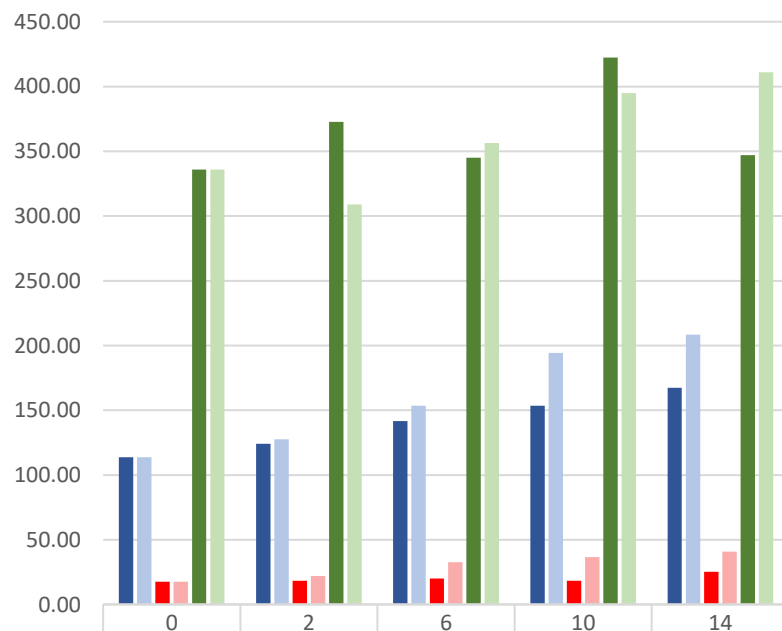
Diubek 44



	0	2	6	10	14
Leaf area [cm2]	93.32	98.81	107.87	112.30	114.66
Leaf area control [cm2]	93.32	109.37	114.28	118.22	125.21
Height [cm]	46.3	48.2	50.0	51.7	56.0
Height control [cm]	46.3	54.5	56.5	61.3	66.7
SPAD	372	331	237	371	343
SPAD control	360	316	357	363	387

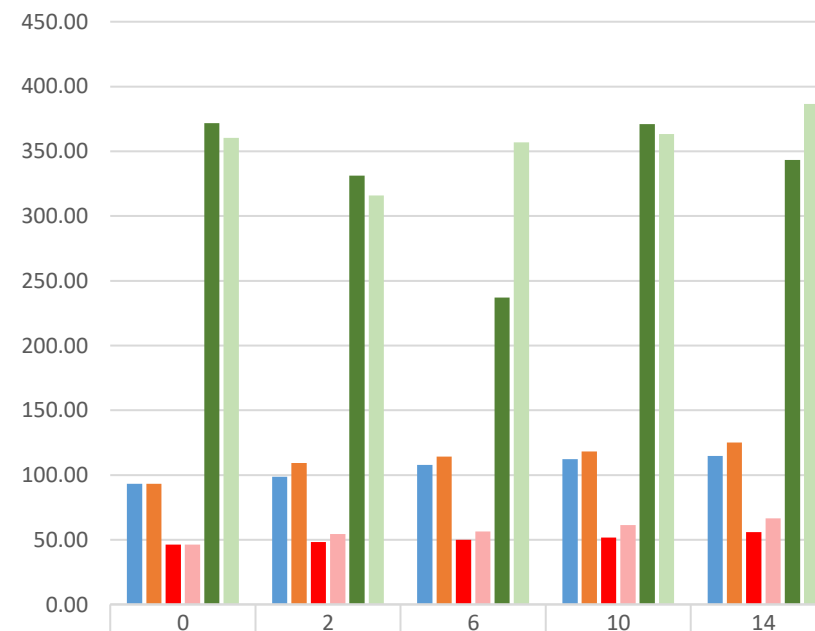
# Results – plant height

Wigola



	0	2	6	10	14
■ Leaf area [cm2]	113.76	124.11	141.74	153.45	167.35
■ Leaf area control [cm2]	113.76	127.50	153.48	194.35	208.52
■ Height [cm]	17.7	18.5	20.1	18.5	25.3
■ Height control [cm]	17.7	22.0	32.7	36.7	41.0
■ SPAD	336	373	345	422	347
■ SPAD control	336	309	357	395	411

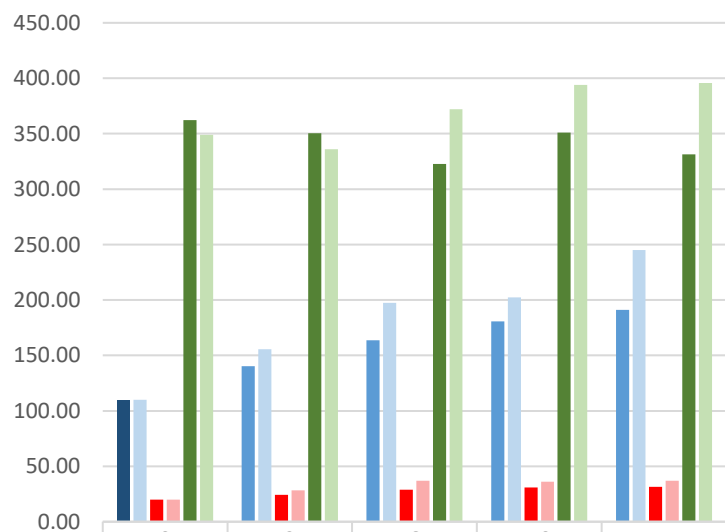
Diubek 44



	0	2	6	10	14
■ Leaf area [cm2]	93.32	98.81	107.87	112.30	114.66
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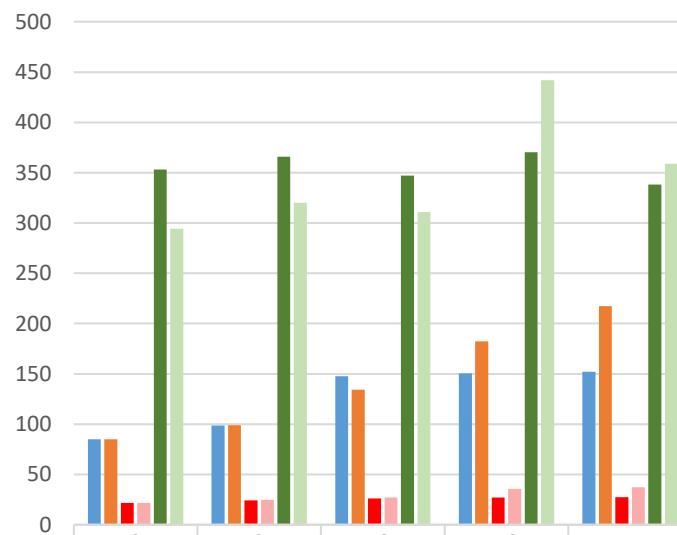
# Results – plant height

VRG 10 TL



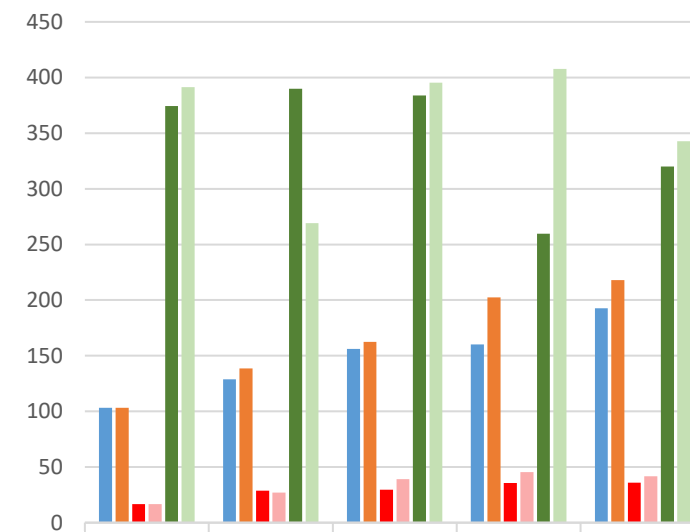
	0	2	6	10	14
■ Leaf area [cm <sup>2</sup> ]	110.08	140.31	163.54	180.72	191.02
■ Leaf area control [cm <sup>2</sup> ]	110.08	155.55	197.54	202.40	245.01
■ Height [cm]	20.0	24.3	29.0	31.0	31.4
■ Height control [cm]	20.0	28.3	37.0	36.0	37.0
■ SPAD	362	350	323	351	331
■ SPAD control	349	336	372	394	396

VRG 4



	0	2	6	10	14
■ Leaf area [cm <sup>2</sup> ]	85	98.72	147.57	150.59	152.09
■ Leaf area control [cm <sup>2</sup> ]	84.96	99.10	134.44	182.22	217.26
■ Height [cm]	21.7	24.3	26.0	27.0	27.3
■ Height control [cm]	21.7	25.0	27.0	35.7	37.3
■ SPAD	353	366	347	370	338
■ SPAD control	294	320	311	442	359

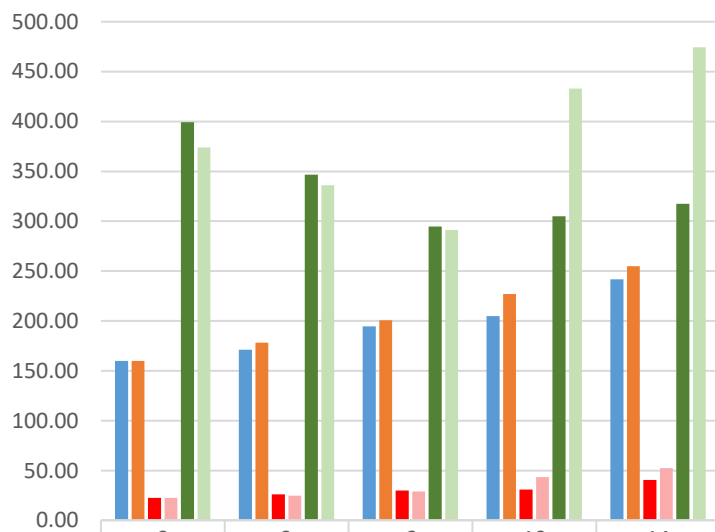
HYV 28



	0	2	6	10	14
■ Leaf area [cm <sup>2</sup> ]	103	128.83	156.17	160.08	192.68
■ Leaf area control [cm <sup>2</sup> ]	103.16	138.6	162.55	202.34	218.04
■ Height [cm]	16.7	28.7	29.7	35.7	36.0
■ Height control [cm]	16.7	27.0	39.0	45.3	41.7
■ SPAD	374	390	384	260	320
■ SPAD control	391	269	396	408	343

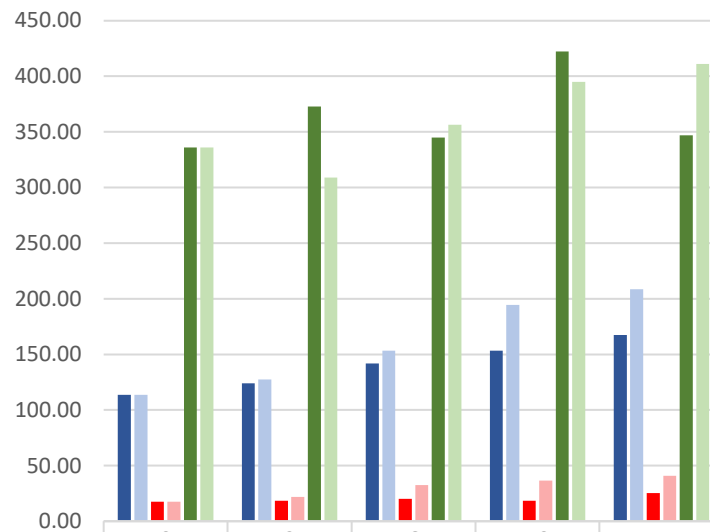
# Results – plant height

Nicola



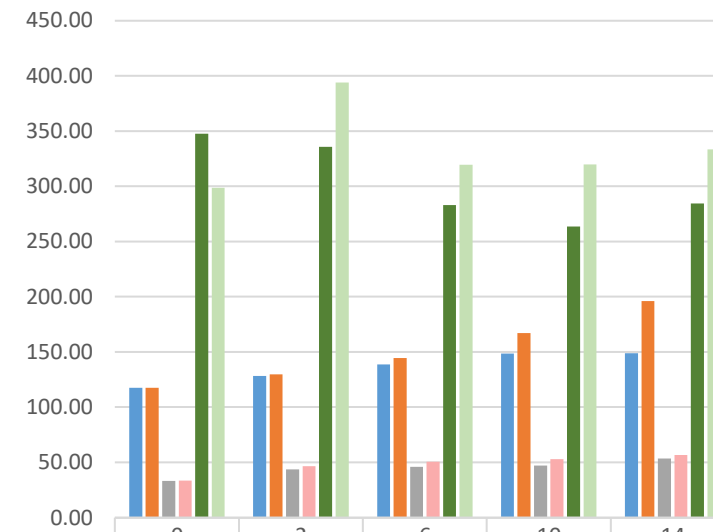
	0	2	6	10	14
Leaf area [cm <sup>2</sup> ]	159.97	171.03	194.70	204.93	241.90
Leaf area control [cm <sup>2</sup> ]	159.97	178.24	200.76	226.98	254.90
Height [cm]	22.7	26.1	30.0	31.0	40.7
Height control [cm]	22.7	25.0	29.0	43.5	52.3
SPAD	399	347	295	305	317
SPAD control	374	336	291	433	474

Wigola



	0	2	6	10	14
Leaf area [cm <sup>2</sup> ]	113.76	124.11	141.74	153.45	167.35
Leaf area control [cm <sup>2</sup> ]	113.76	127.50	153.48	194.35	208.52
Height [cm]	17.7	18.5	20.1	18.5	25.3
Height control [cm]	17.7	22.0	32.7	36.7	41.0
SPAD	336	373	345	422	347
SPAD control	336	309	357	395	411

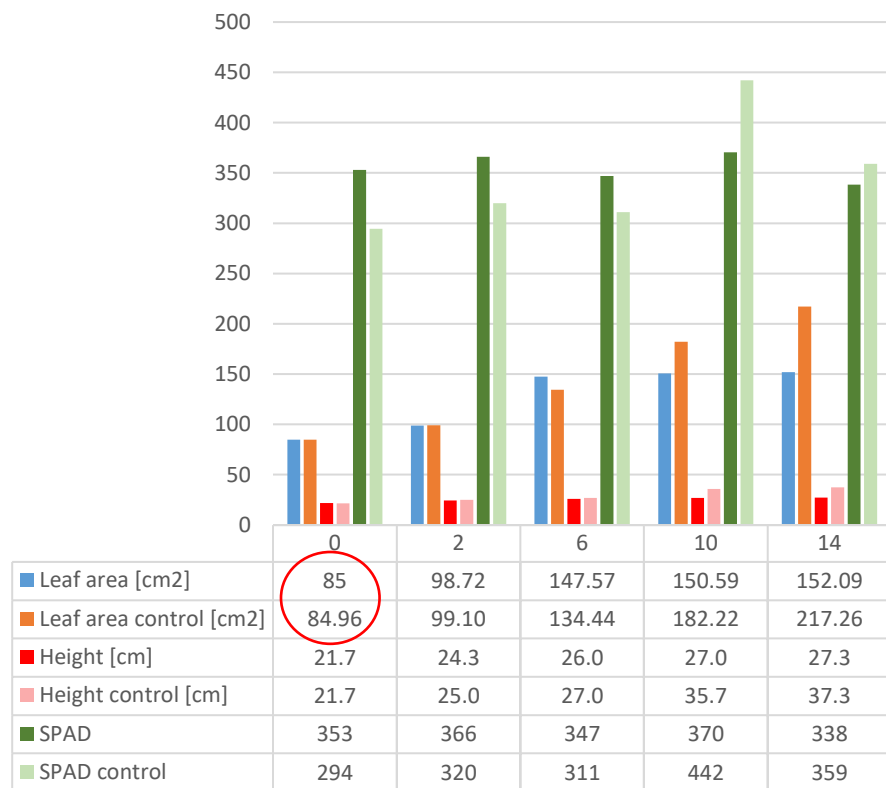
Samsun H



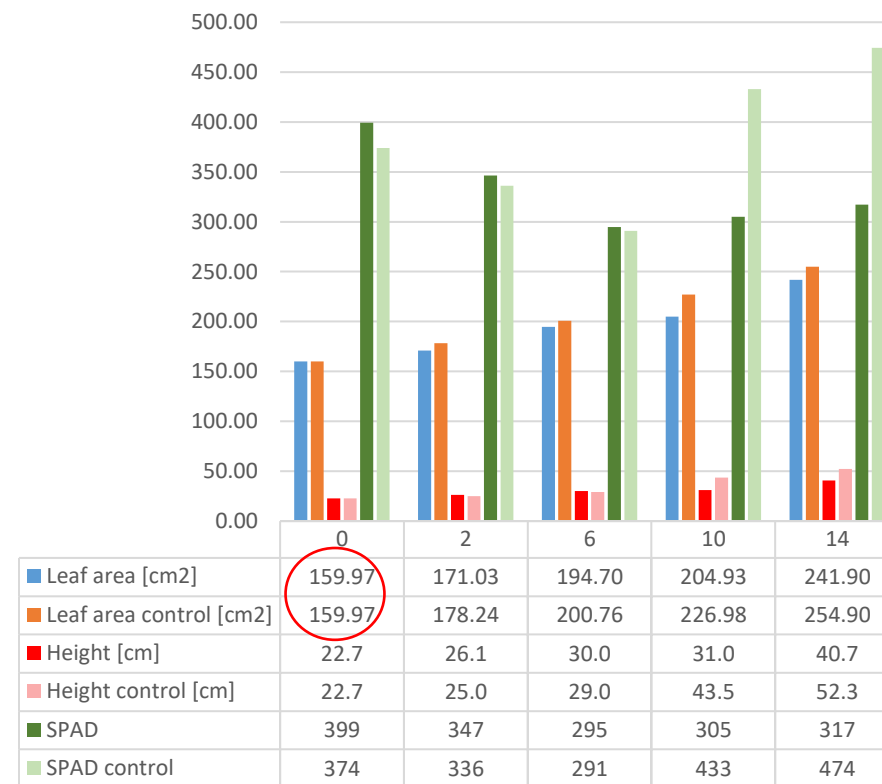
	0	2	6	10	14
Leaf area [cm <sup>2</sup> ]	117.65	128.12	138.75	148.44	148.78
Leaf area control [cm <sup>2</sup> ]	117.65	129.78	144.33	166.94	195.96
Height [cm]	33.3	43.7	45.8	47.0	53.5
Height control [cm]	33.3	46.5	50.5	53.0	56.7
SPAD	348	336	283	264	284
SPAD control	299	394	320	320	333

# Results – leaf surface area

VRG 4



Nicola



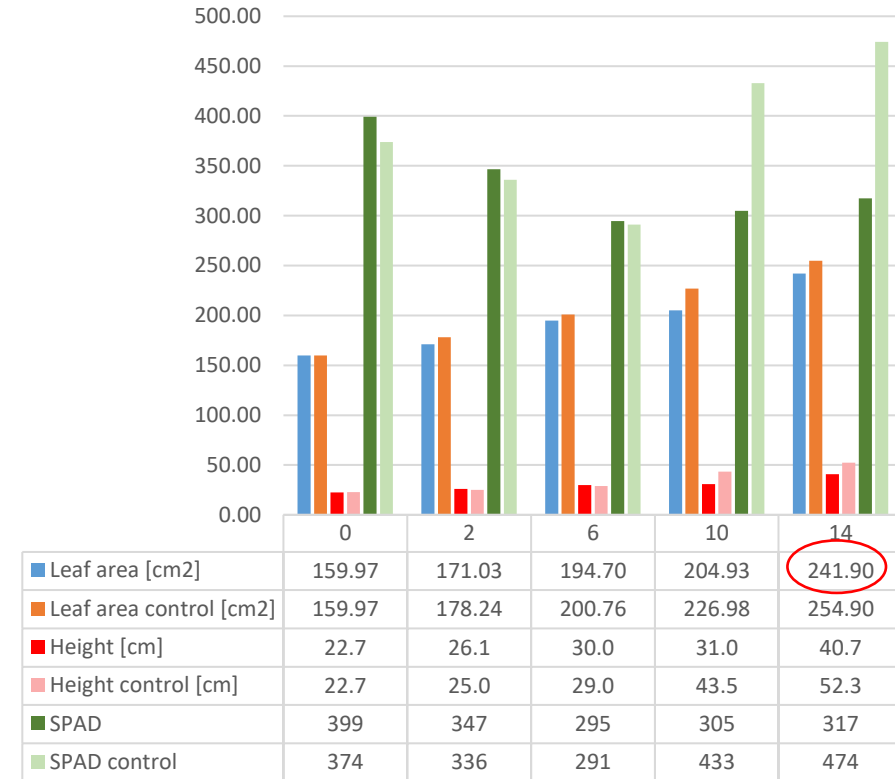


# Results – leaf surface area

Smirna 155

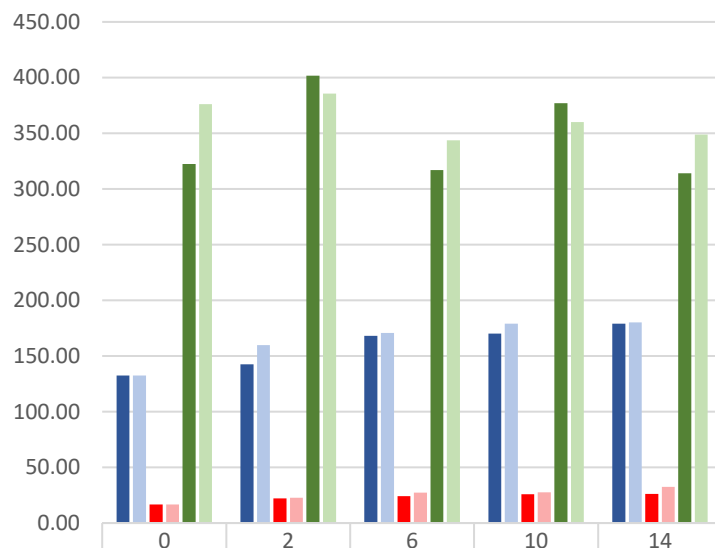


Nicola



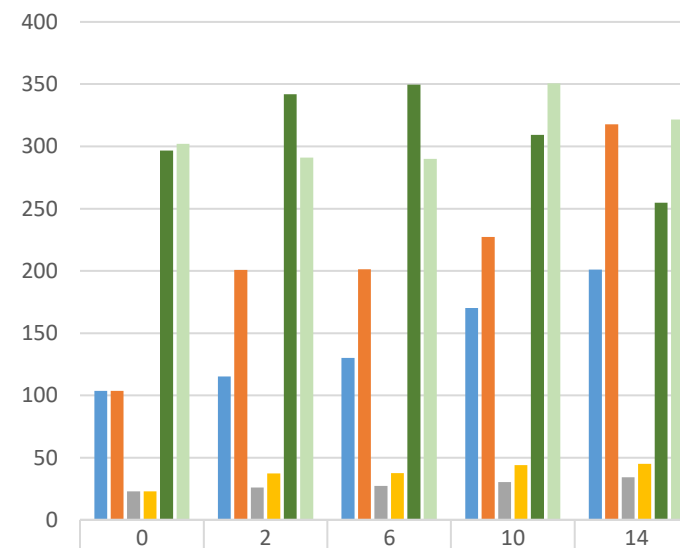
# Results – leaf surface area

BPTN 151



	0	2	6	10	14
■ Leaf area [cm <sup>2</sup> ]	132.48	142.44	167.93	170.17	179.03
■ Leaf area control [cm <sup>2</sup> ]	132.48	159.83	170.63	179.00	180.20
■ Height [cm]	16.7	22.0	24.0	25.7	26.0
■ Height control [cm]	16.7	22.5	27.3	27.5	32.5
■ SPAD	322	402	317	377	314
■ SPAD control	376	386	344	360	349

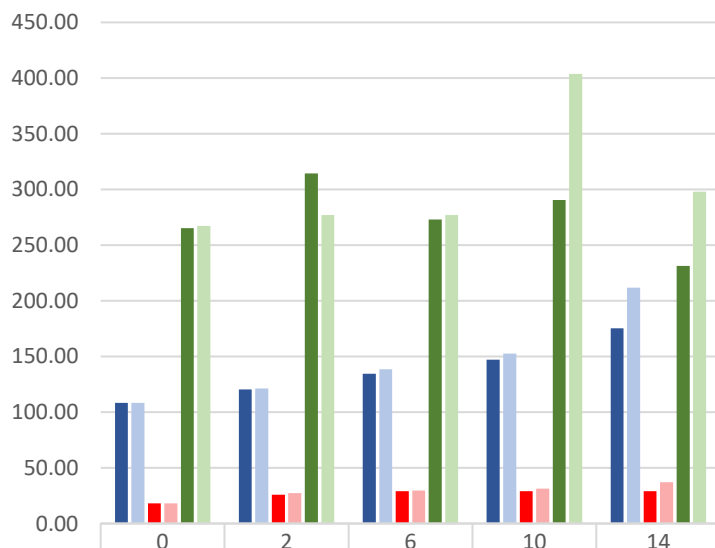
PH 168 cms



	0	2	6	10	14
■ Leaf area [cm <sup>2</sup> ]	104	115	130.18	170.26	201.14
■ Leaf area control [cm <sup>2</sup> ]	103.59	200.79	201.37	227.18	317.79
■ Height [cm]	23	26.0	27.3	30.5	34.3
■ Height control [cm]	22.8	37.3	37.5	44.0	45.0
■ SPAD	297	342	350	309	255
■ SPAD control	302	291	290	351	322

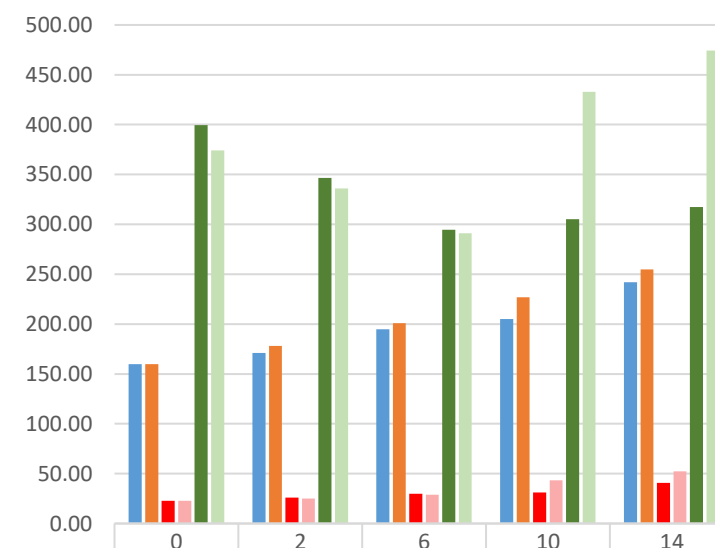
# Results – SPAD index

Baca



	0	2	6	10	14
■ Leaf area [cm2]	108.27	120.46	134.64	147.06	175.38
■ Leaf area control [cm2]	108.27	121.35	138.6	152.72	211.70
■ Height [cm]	18.2	26.0	29.0	29.0	29.0
■ Height control [cm]	18	27	30	31	37.0
■ SPAD	265	314	273	291	231
■ SPAD control	267	277	277	404	298

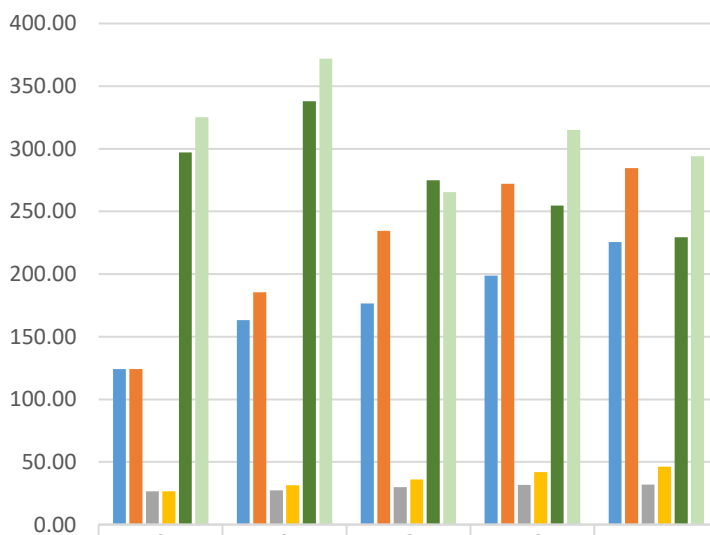
Nicola



	0	2	6	10	14
■ Leaf area [cm2]	159.97	171.03	194.70	204.93	241.90
■ Leaf area control [cm2]	159.97	178.24	200.76	226.98	254.90
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■ Height control [cm]	22.7	25.0	29.0	43.5	52.3
■ SPAD	399	347	295	305	317
■ SPAD control	374	336	291	433	474

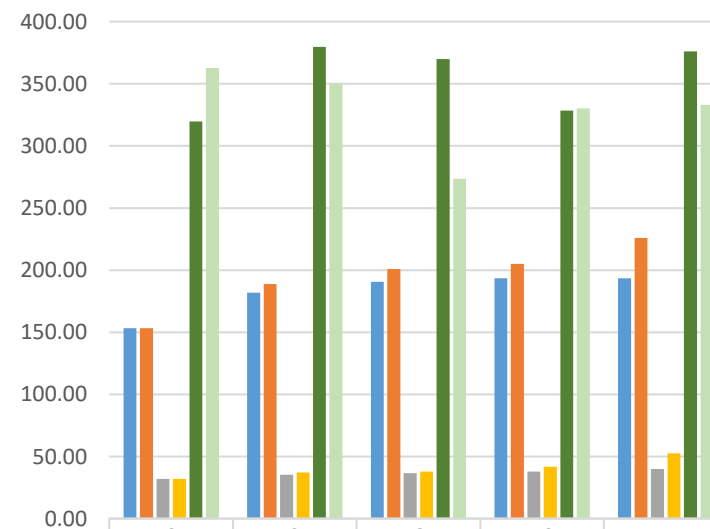
# Results – SPAD index

Hamar



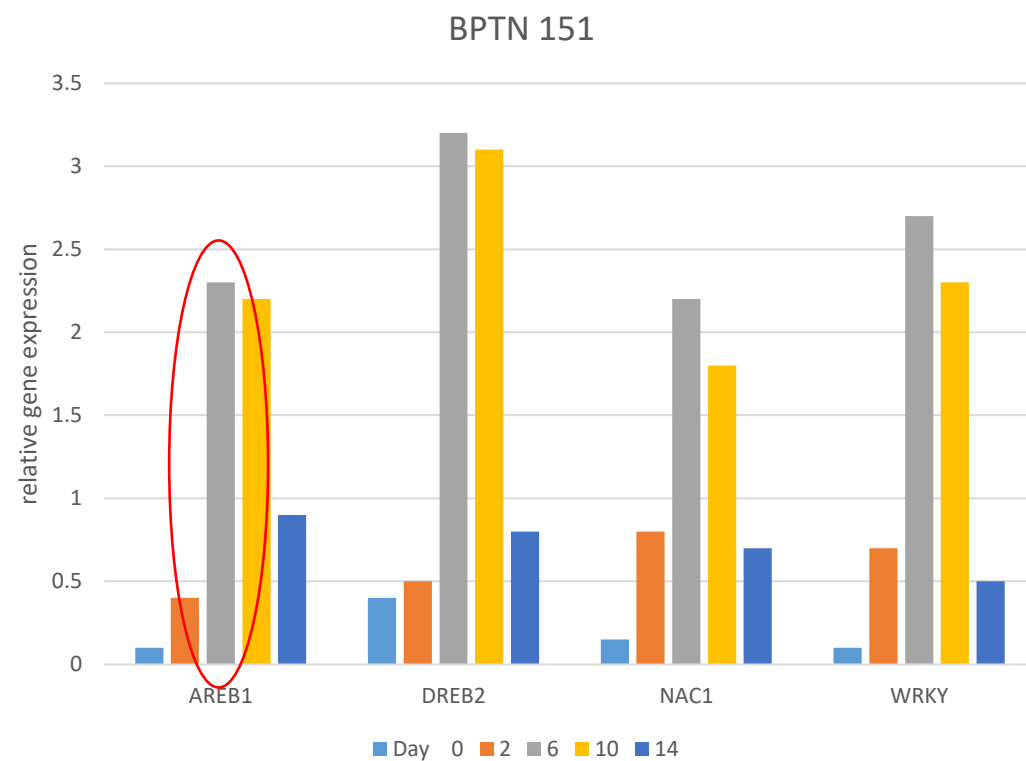
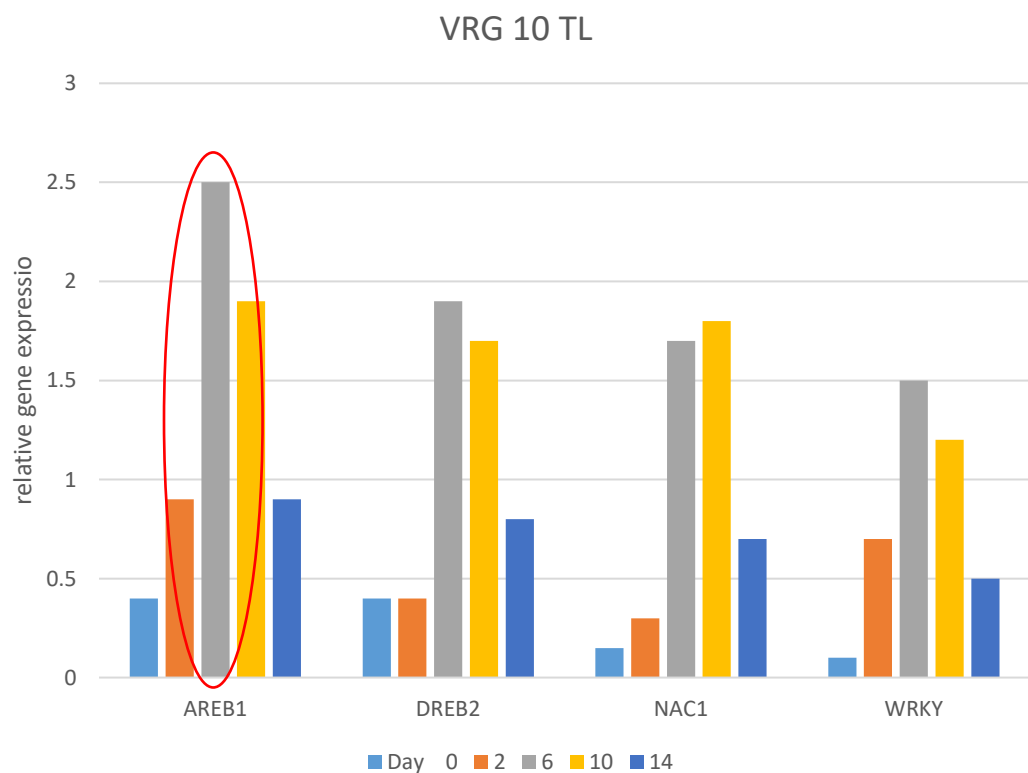
	0	2	6	10	14
Leaf area [cm2]	124.09	163.21	177	198.84	225.55
Leaf area control [cm2]	124.09	185.50	234.60	272.21	284.63
Height [cm]	26.5	27.3	30.0	31.7	32.0
Height control [cm]	26.5	31.3	36.0	42.0	46.3
SPAD	297	338	275	255	230
SPAD control	325	372	266	315	294

Trapezund Puławski

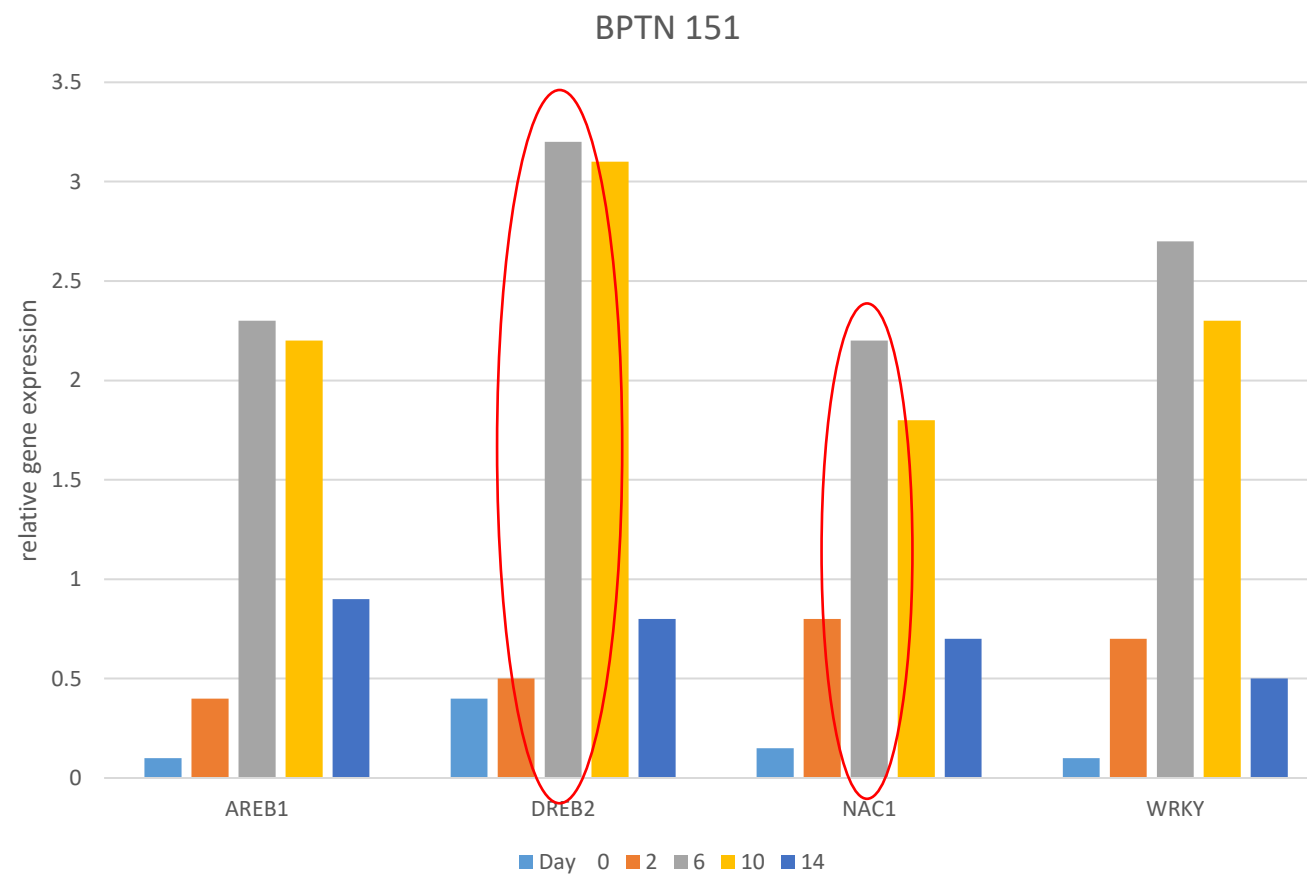


	0	2	6	10	14
Leaf area [cm2]	153.18	181.80	190.58	193.36	193.43
Leaf area control [cm2]	153.18	188.83	200.99	205.10	225.86
Height [cm]	32.0	35	36.7	38.0	40.0
Height control [cm]	32	37.0	38.0	41.7	52.7
SPAD	320	380	370	328	376
SPAD control	363	350	274	330	333

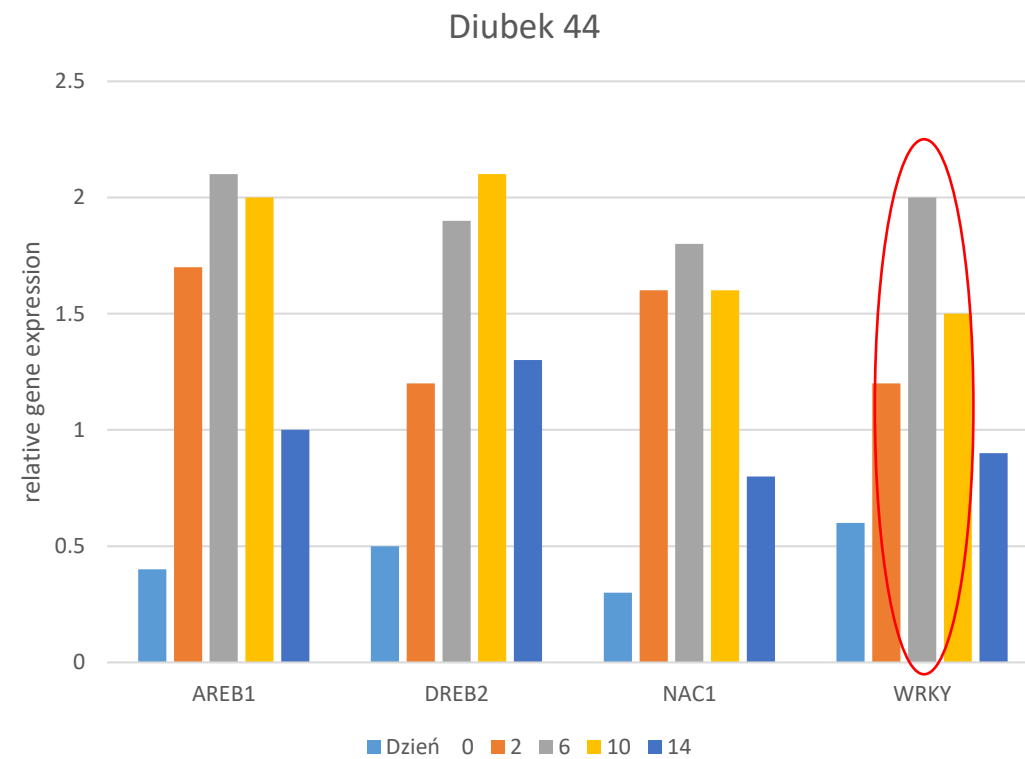
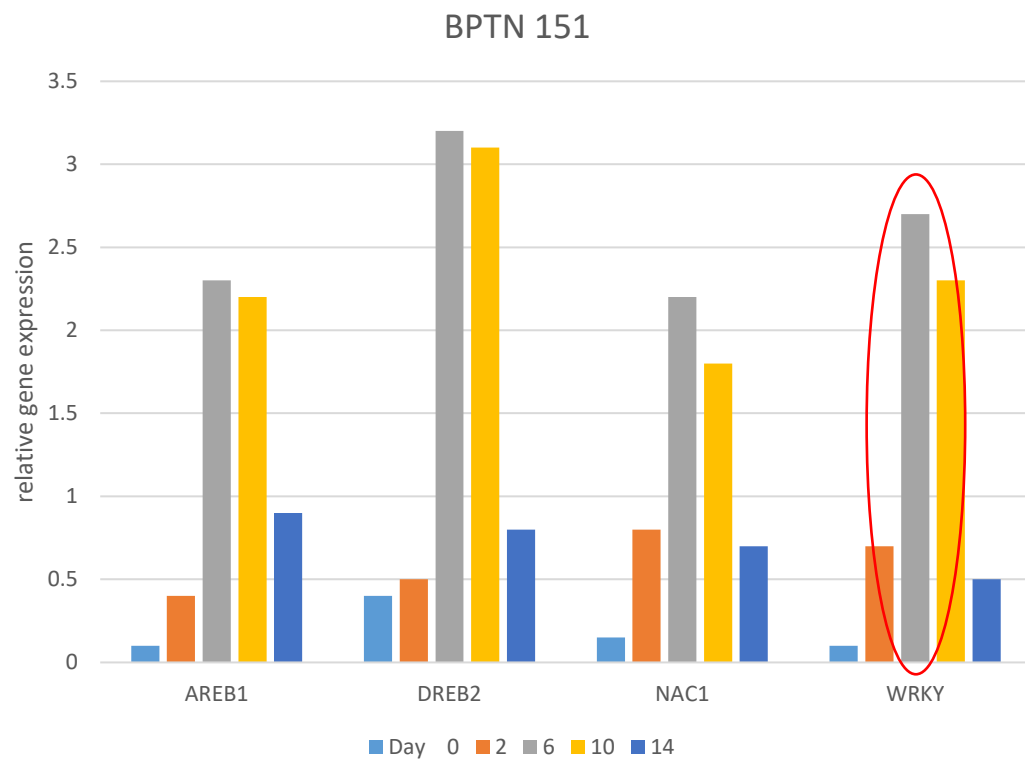
# Results – AREB1 gene



# Results – DREB2 gene



# Results – WRKY gene



## Conclusion

- limited access to water has a negative impact on the course of many physiological processes.
- there is a variation between the cultivars of tobacco in terms of sensitivity to drought stress
- BPTN 151 and VPPG 78 cultivars showed the highest tolerance to drought stress among the 17 tested tobacco genotypes



# Thank you

Marcin Przybyś

Institute of Soil Science and Plant Cultivation – State Research Institute

Department of Plant Breeding and Biotechnology

Puławy, Poland

[mprzybys@iung.pulawy.pl](mailto:mprzybys@iung.pulawy.pl)

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