Irrigation Management for Cotton

NC STATE UNIVERSITY

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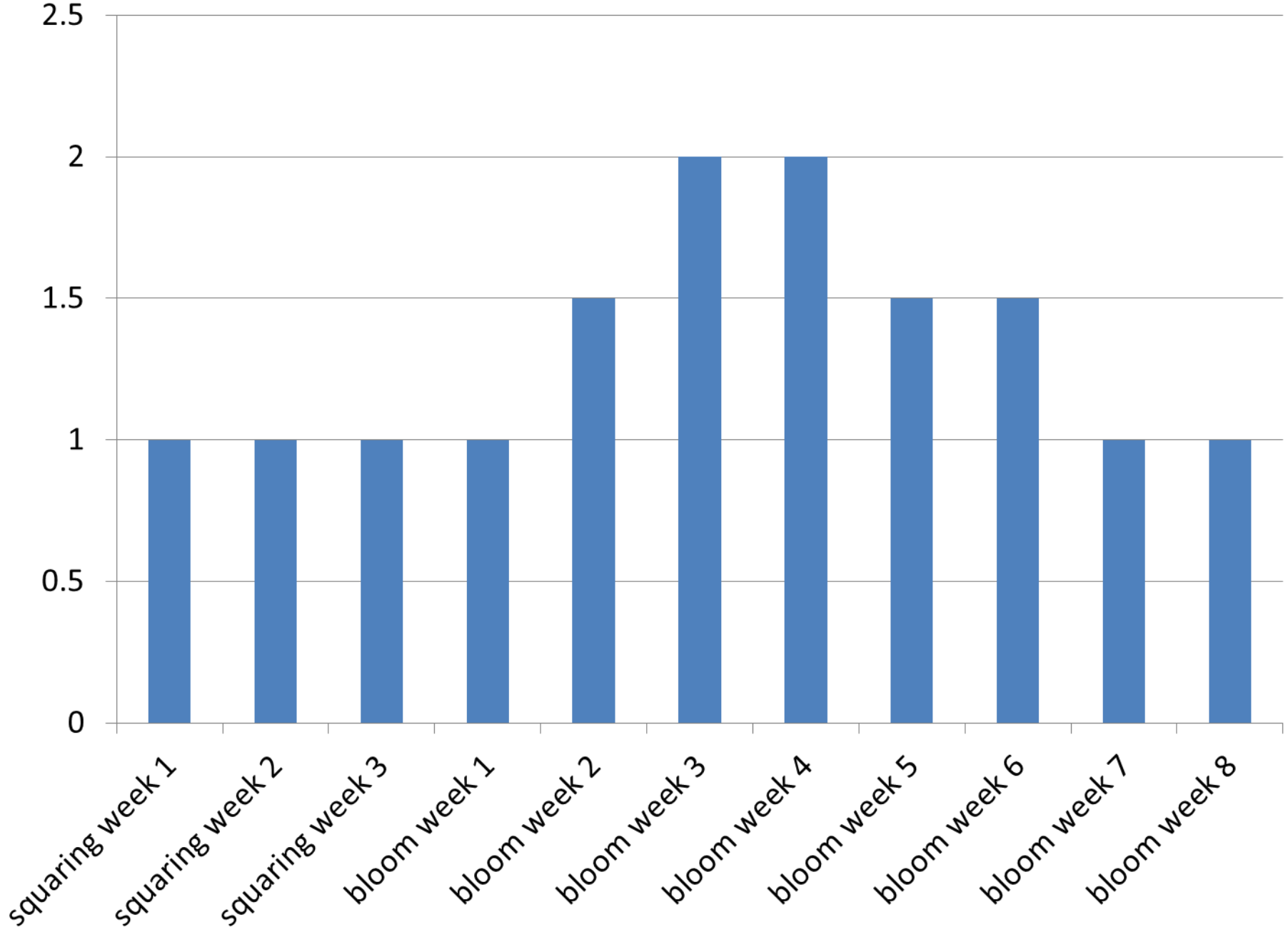
March 6-7th, 2018

2016 NC On-Farm Trials (TOP 3 of 8 Varieties - Statewide)

Variety	1	2	3	4	5	6	7	8	9	10	11	12	13	AVG Yield
DP 1646	555	642	**752**	**773**	**761**	**913**	**953**	**1066**	**891**	**1000**	**1063**	**1201**	**2188**	981
NG 3522	**609**	**724**	**733**	**804**	709	**783**	**840**	843	**950**	**981**	927	1008	1957	913
PHY 312	**626**	**653**	**776**	**807**	721	755	**898**	880	843	967	931	984	1843	899
ST 4848	**572**	616	656	631	650	732	783	**884**	**899**	**1005**	**955**	**1234**	**1961**	891
DG 3526	552	**785**	440	740	**759**	**775**	551	855	889	977	946	**1061**	**2038**	874
PHY 444	502	630	690	632	736	683	710	869	847	843	**973**	1000	1956	852
NG 3405	536	540	686	606	663	714	810	795	887	906	850	1055	1811	835
DG 3757	498	643	572	767	**804**	625	501	**935**	865	884	875	930	1929	833
Trial AVG	556	654	647	720	725	748	756	891	884	945	940	1059	1960	

100 % UGA Checkbook (in/week)



Irrigation Considerations

- Know efficiency of irrigation system (60-95%) and soil water holding capacity (0.6-1.8 inches per foot)
  - High pressure Impact sprinklers (75-85%), Low pressure Spray sprinklers with drop hoses (90-95%) (Vellidis 2014), travelling gun = 50%...maybe 60% (Bednarz)

- Keep close track of growth stages
  - 1st square
  - 1st bloom
  - 1st open boll (length of bloom period may vary)

- Utilization of sensors in concert with weekly checkbook
  - Adjust for soil type and retention of moisture (20-60 kPa) (Vellidis, 2014)
  - Account for rainfall….when to resume irrigation
  - Quantify when stress may be encountered
    - ET, Heat, boll demands, etc
    - Wilting indicates you are WAY too late

Irrigation Considerations

- Split apply weekly rates into 2-3 applications
  - System capacity and time required for application
  - Adjust for rainfall (any meaninful rainfall > 0.2-0.3 inches)
  - Soil uptake, runoff, slope, depth to subsoil
  - Prevent complete depletion of soil moisture
  - Short-lived drought can have significant negative effects on yield

Root health

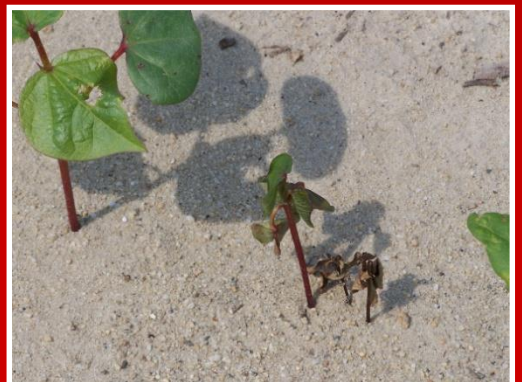
hard pan, acid subsurface, tillage

Maximizing root development prebloom relieves stress during bloom – early stress may position the crop for better productivity if stress occurs during the bloom period

Seedling diseases and nematodes

Seedling diseases affect root development – wilt sooner

Nematodes affect root development and water uptake



Tillage

In addition to root growth, tillage affects water holding capacity, longevity of rain events (retention), and water availability

Strip-till, cover crop

No-till, crop residue

Conventional tillage, no cover

Symptoms of water stress

Wilting – during bloom, also maybe serious if occurs during prebloom

Large terminal squares – prebloom

Non-insect-induced square shed - prebloom

Symptoms of water stress

K deficiency and leafspot

If you know that you applied adequate nutrients and no leaching has occurred…..

N deficiency and defoliation

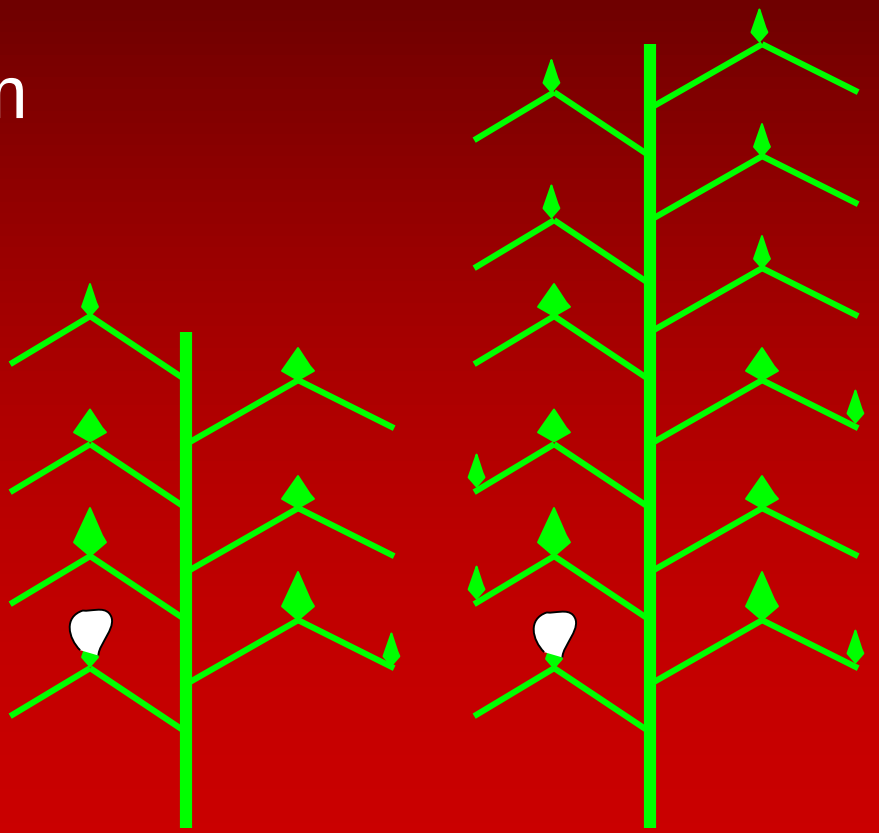
What about…….?

- Cloudy weather = severe square shed
- Plant bugs
- Bollworm
- Top Crop (for whatever reason)

Nodes Above White Bloom

Optimal plant growth:

- 8-11 nodes @ 1st bloom
- 7-9 nodes @ peak bloom
- < 5 nodes @ cutout



Affected by:

- Water availability (drought)
- N availability (deficiency)
- PGR applications

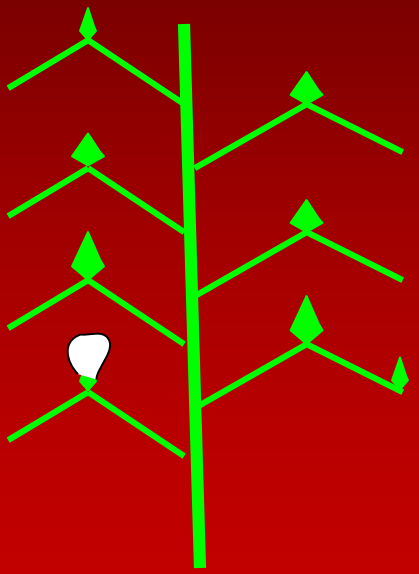
Nodes Above White Bloom

	Start	Middle	End
Sled weight	Light	Moderate	Heavy
Speed	Fast	Slower	Stopped

Nodes Above White Bloom

Prebloom drought:

- fewer nodes at first bloom
- boll load quickly restrains terminal growth
- premature cutout if stress is not immediately relieved very soon after first bloom
- poor boll load (↓yield,↑ regrowth potential) (short staple, high mike)
- square shed if drought is severe (squares = lower water demands)



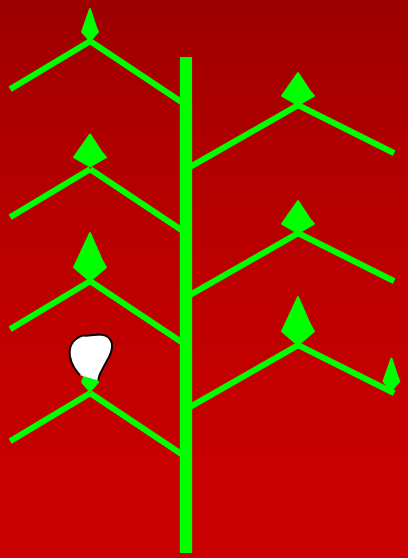
- if stress is mild and relieved by first bloom = better root development, less aggressive plants / vegetative water demands, better growth control, less late-season drought problems
- variety = full season varieties….less distinct cutout, recover from dry periods and form a top crop better than early varieties which fruit up quickly

Water demands and growth stage

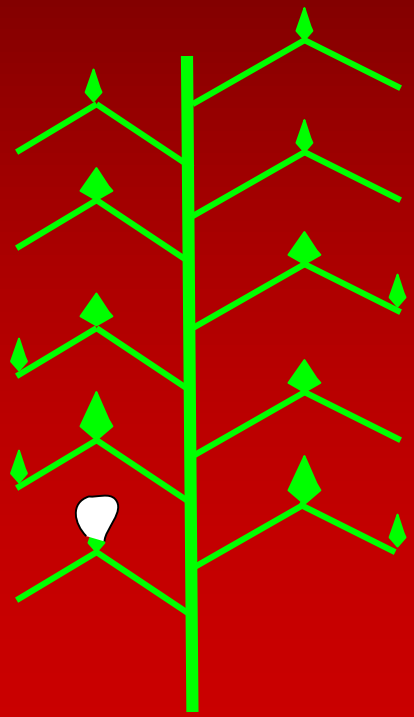
	Lint yield/m^2	Bolls/m^2	Bolls/plant	Lint / boll	Lint / plant
Total water	**0.34**	**0.35**	**0.37**	**0.12**	**0.36**
Planting to square initiation	**- 0.32**	**- 0.18**	**- 0.08**	**- 0.24**	**- 0.22**
Square initiation to 1st flower	**0.73**	**0.58**	**0.54**	**0.65**	**0.68**
1st flower to peak bloom	**0.32**	**0.55**	**0.23**	**0.04**	**0.13**
Peak bloom to maturity	**- 0.43**	**- 0.45**	**- 0.23**	**- 0.56**	**- 0.27**

(Physiology Today, 1999 vol 11, no. 2)

Effects of prebloom drought

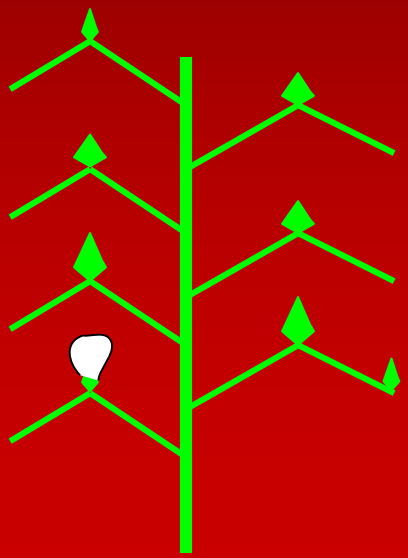


Dry prior to first bloom and soon after



Adequate prebloom soil moisture

Effects of prebloom drought



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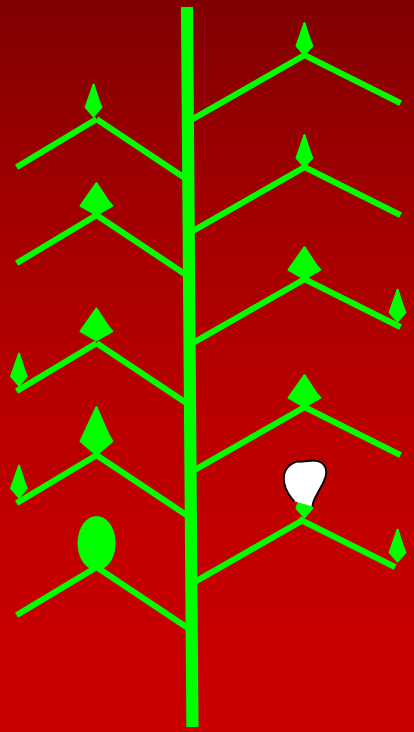

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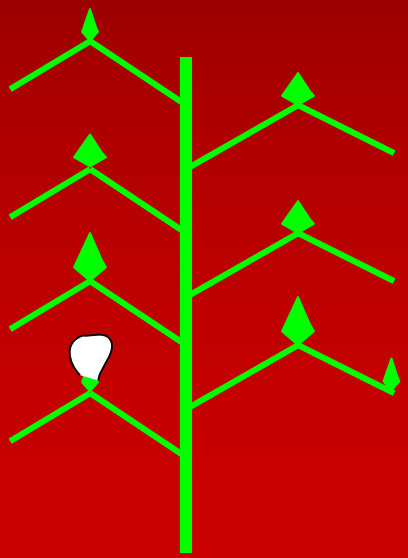

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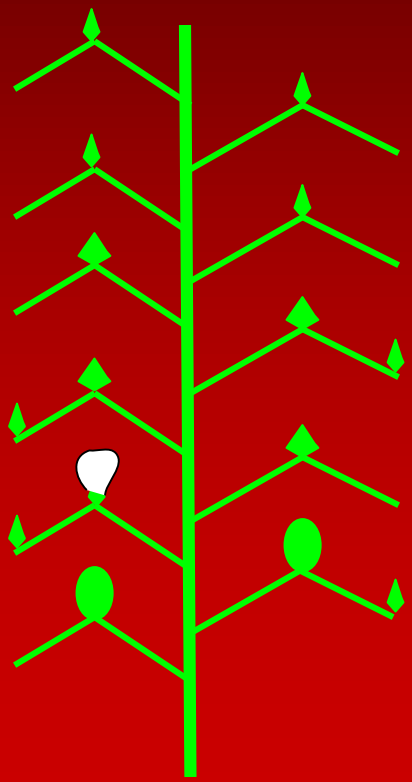

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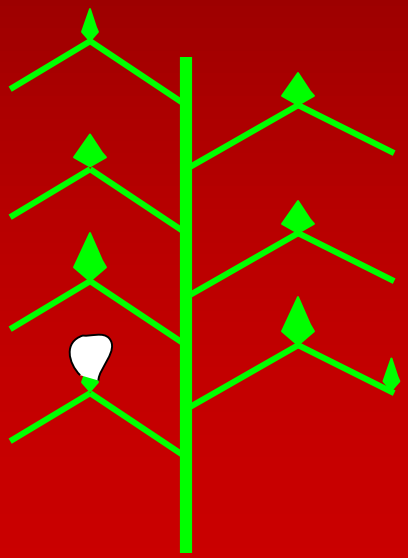

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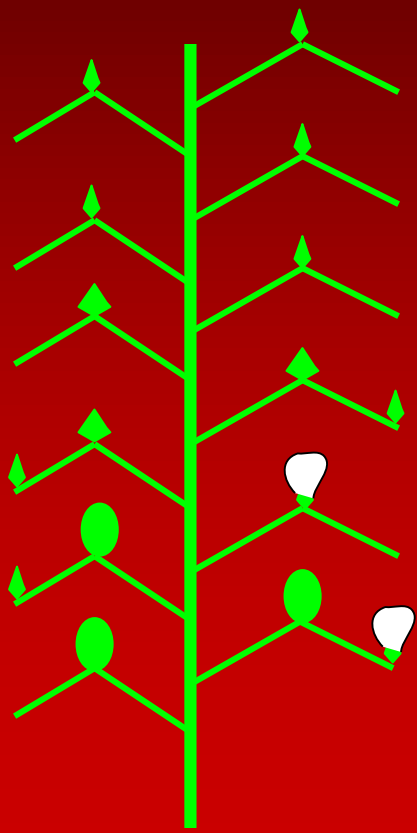

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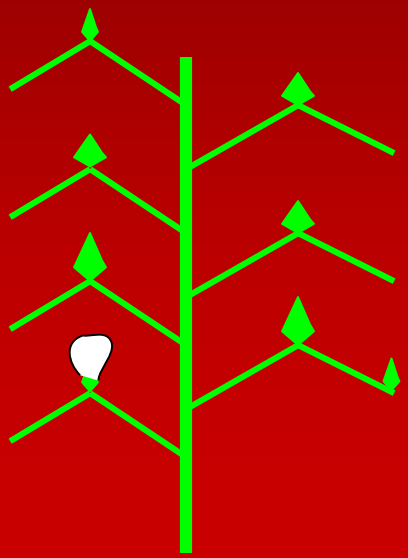

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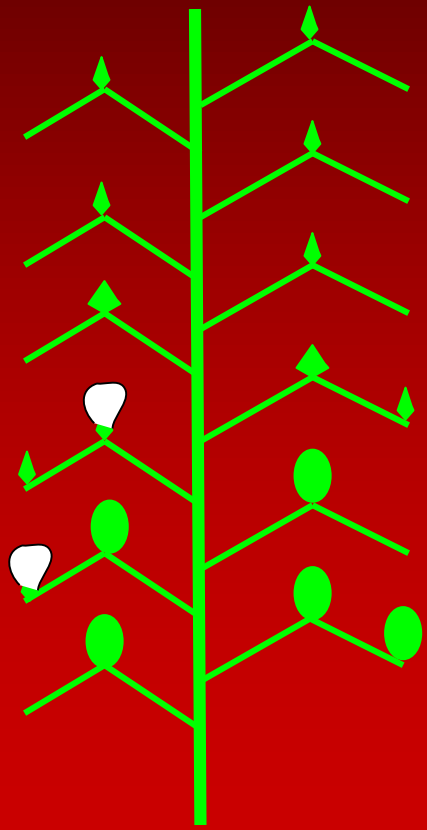

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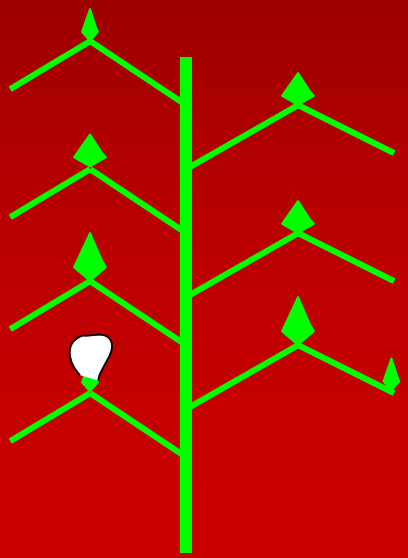

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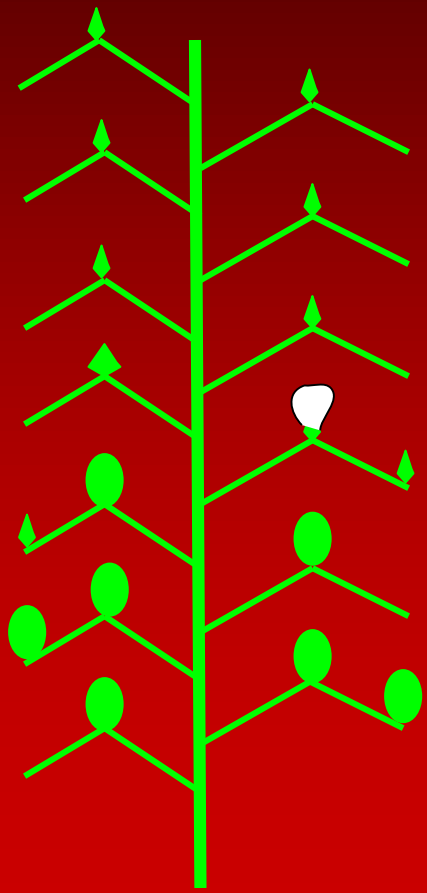

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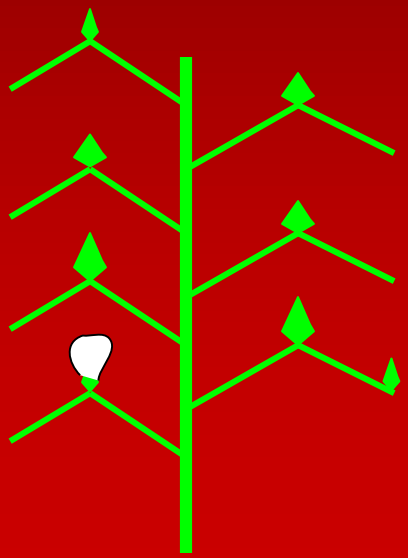

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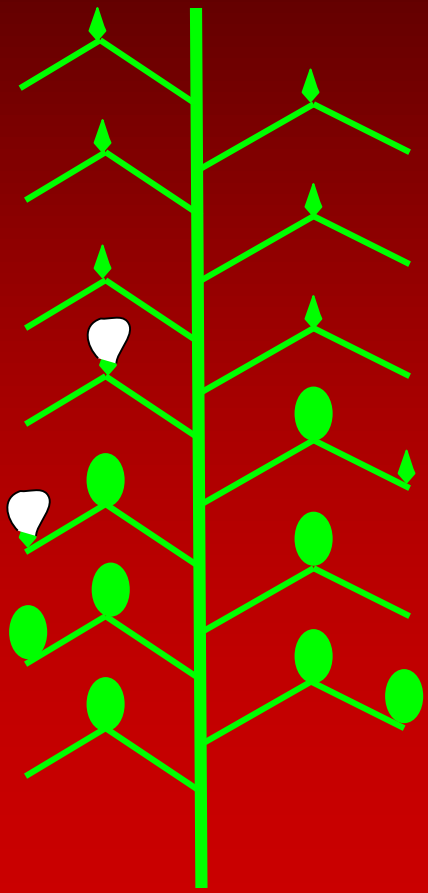

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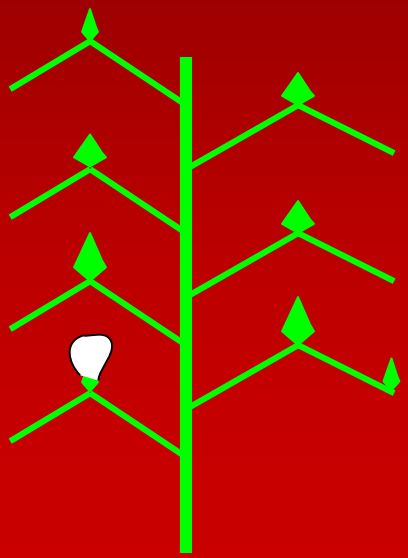

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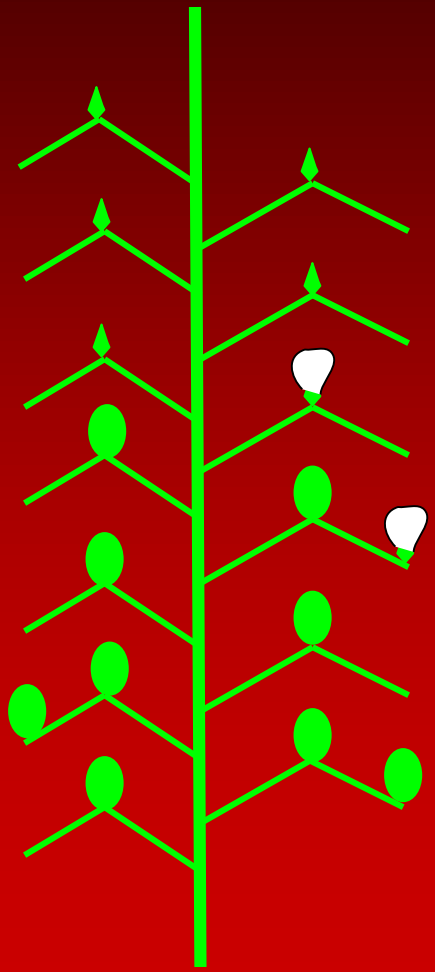

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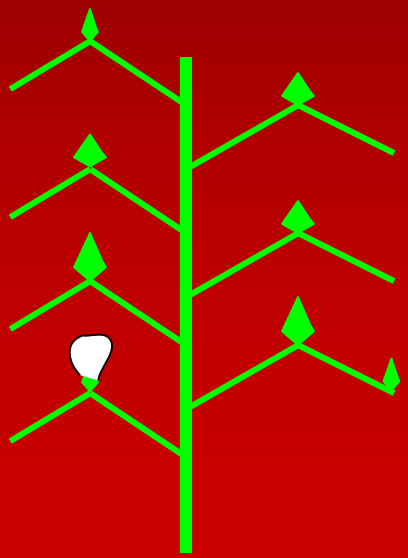

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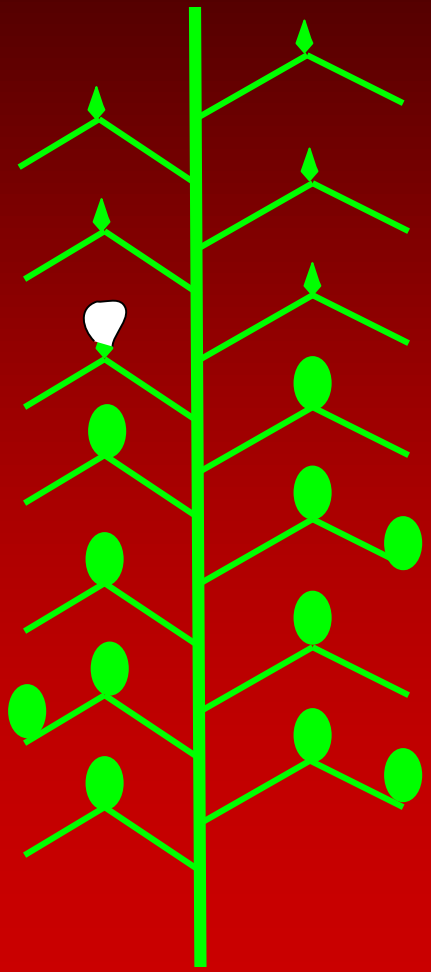

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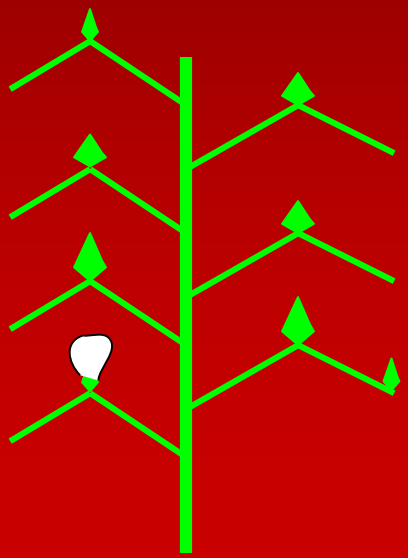

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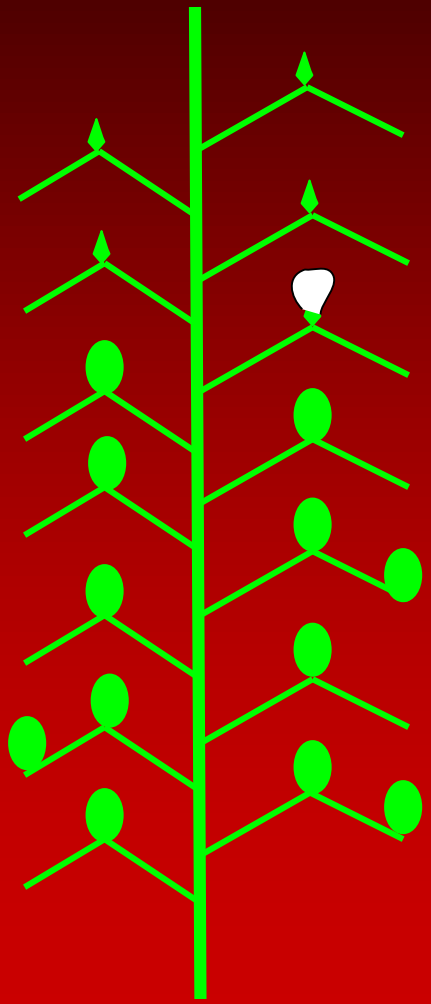

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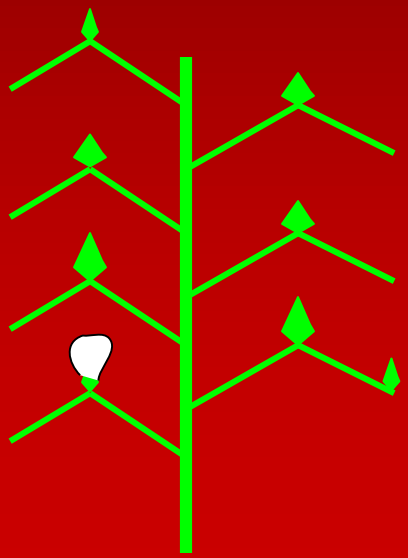

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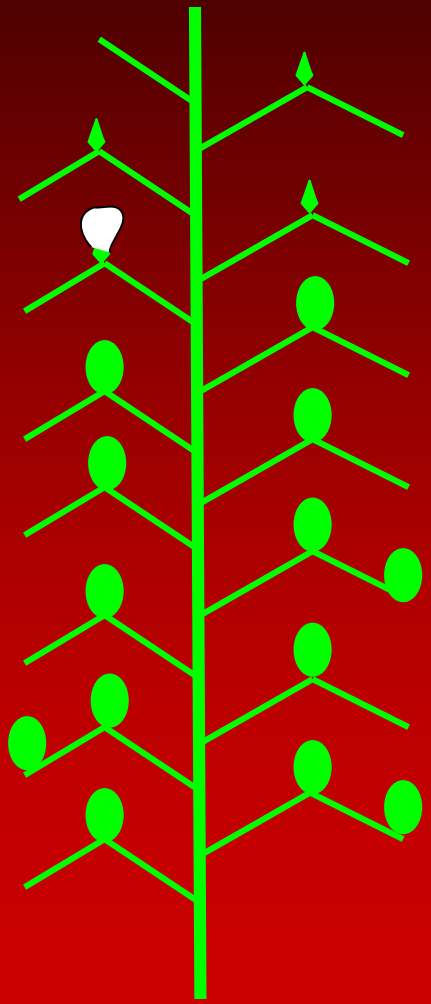

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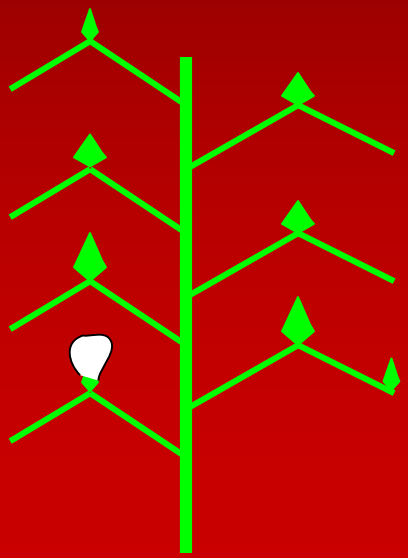

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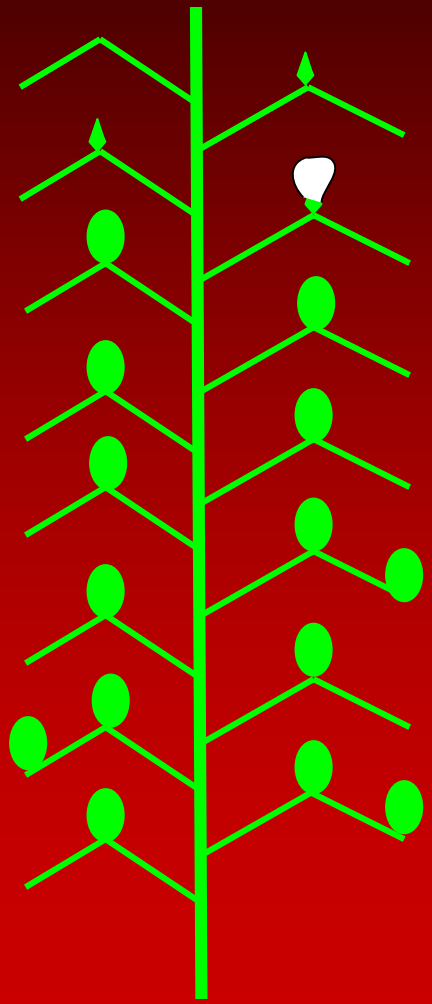

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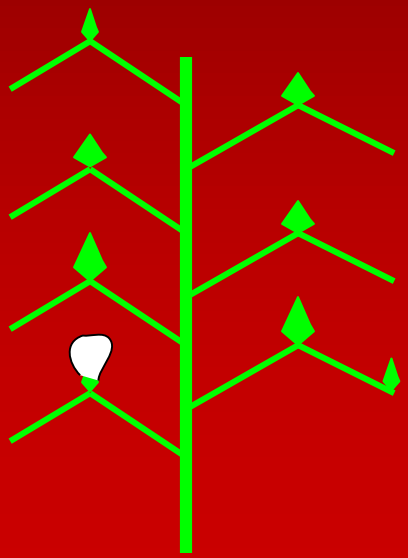

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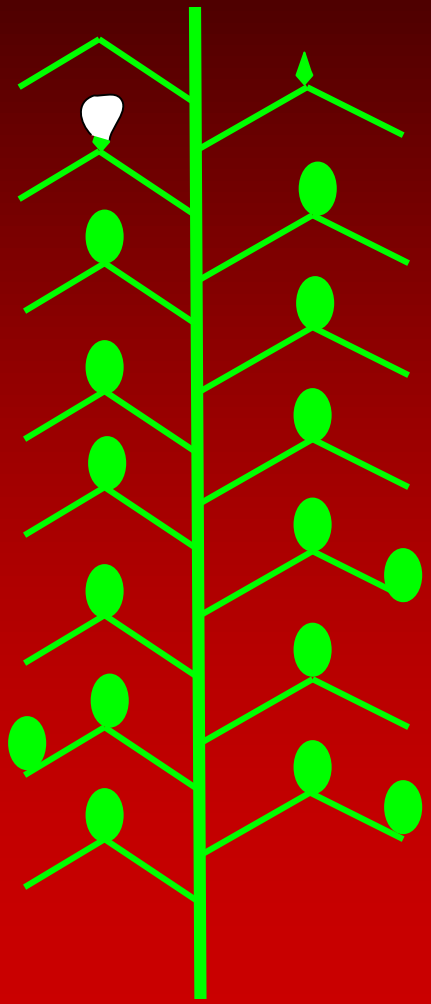

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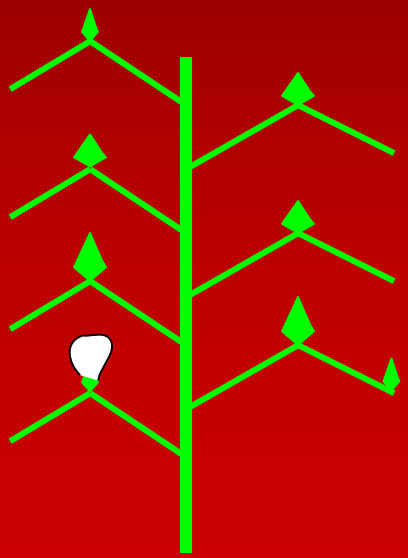

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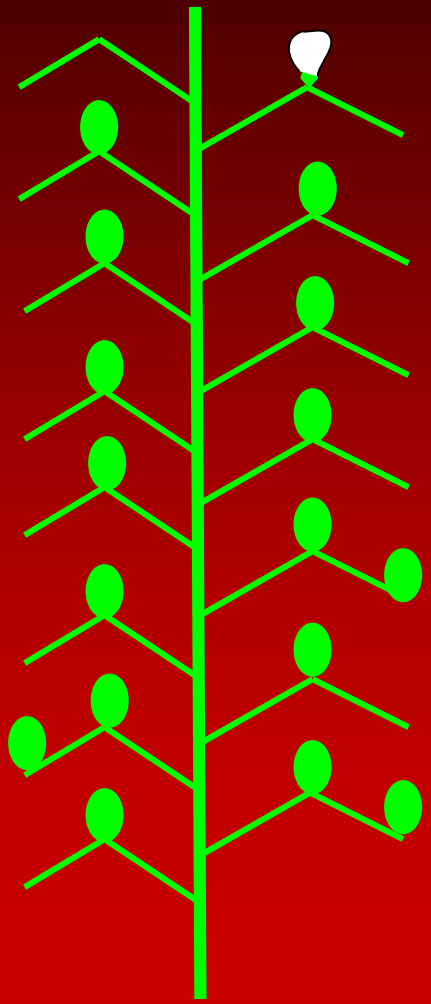

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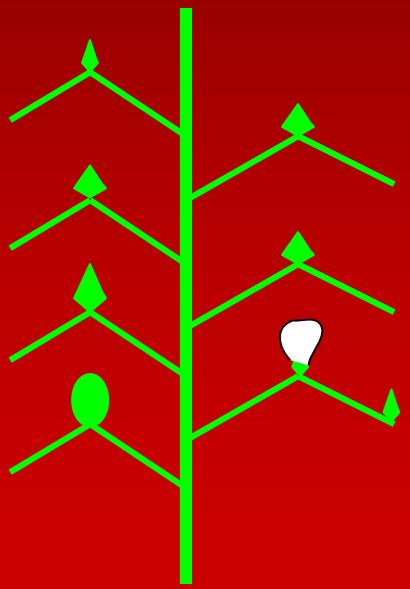

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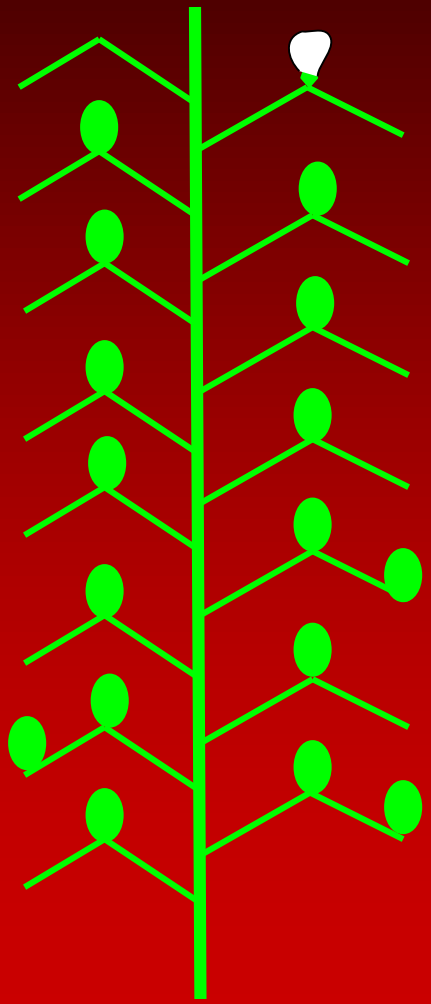

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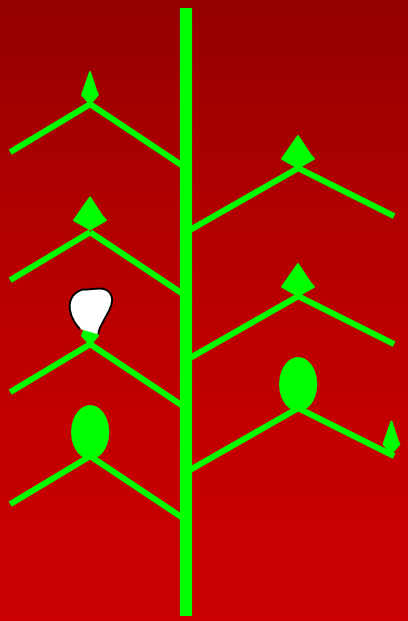

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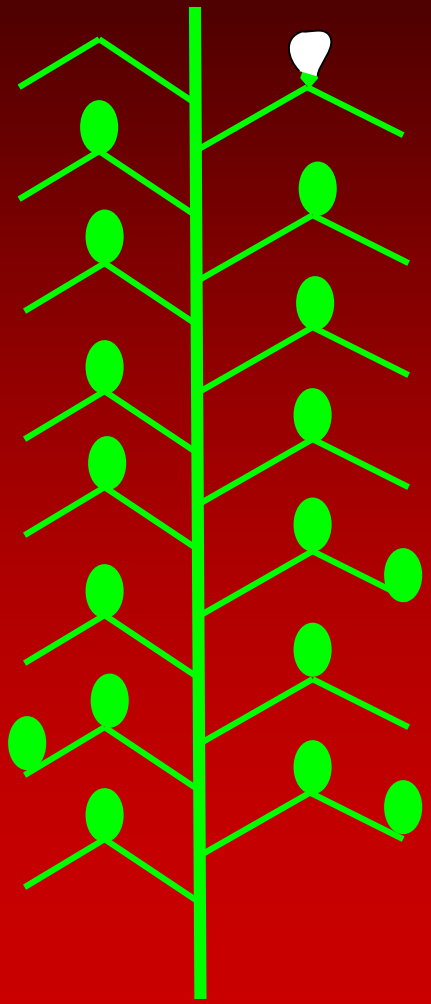

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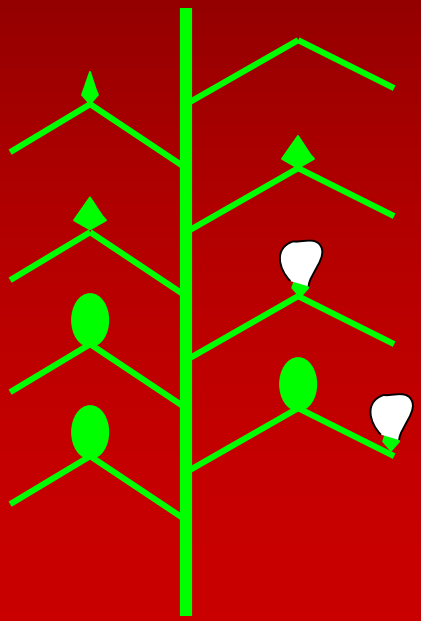

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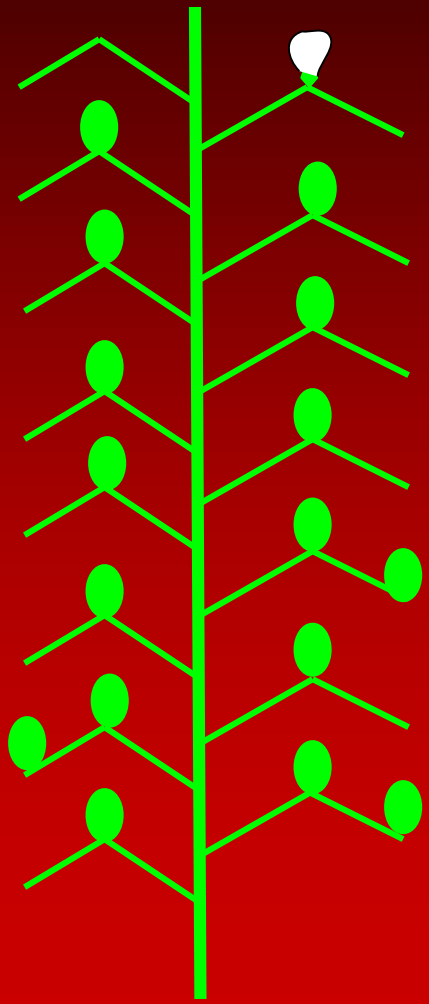

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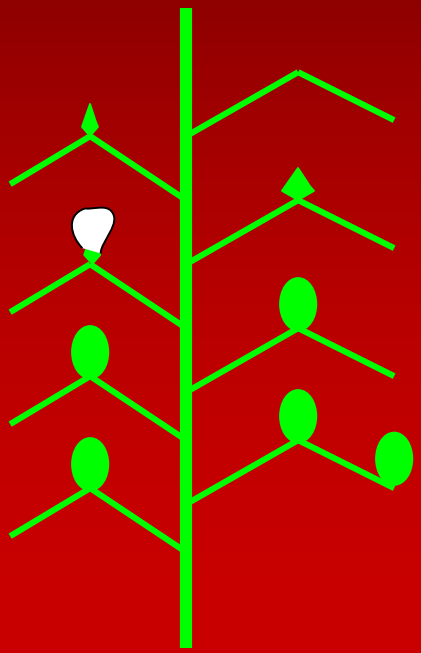

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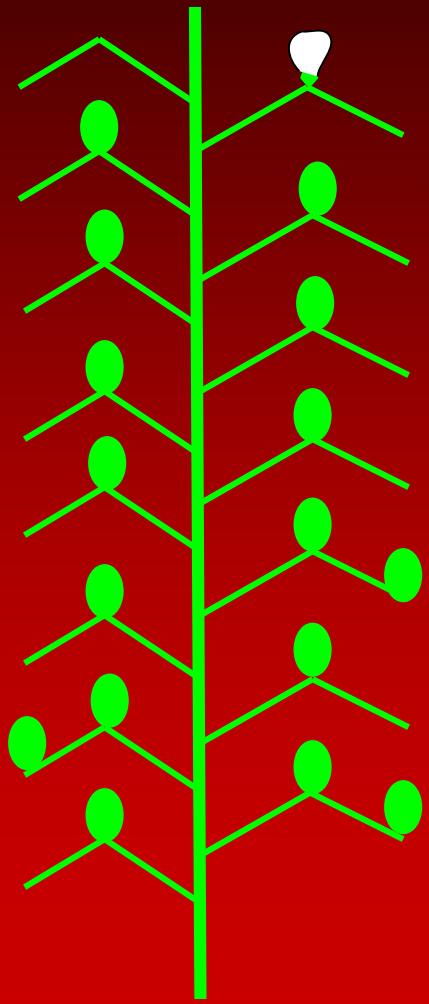

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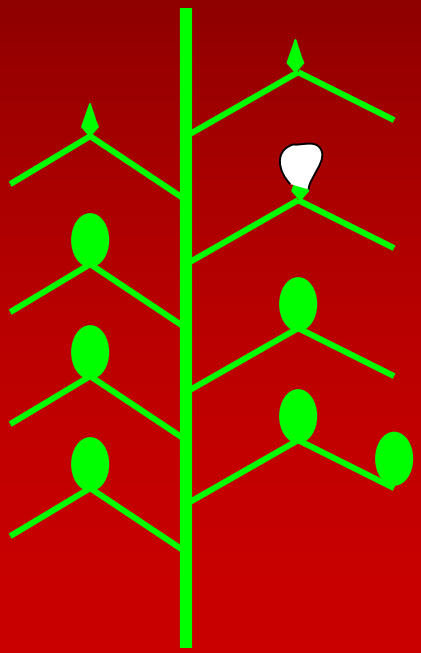

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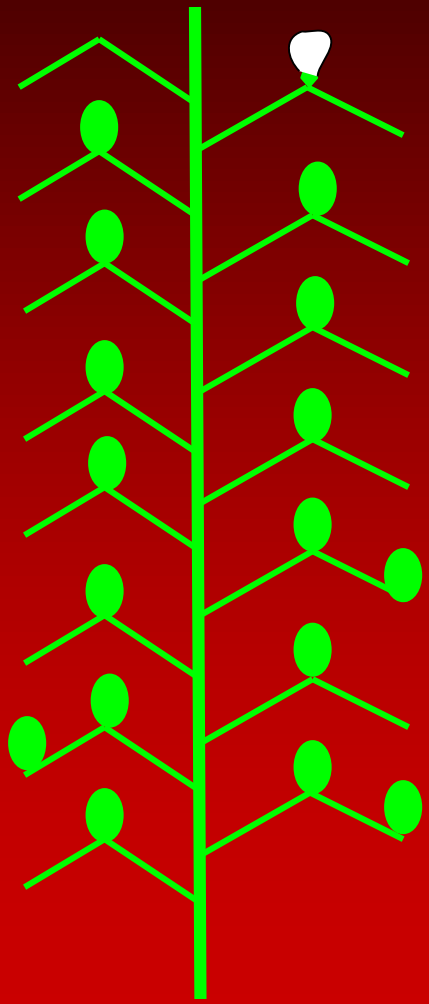

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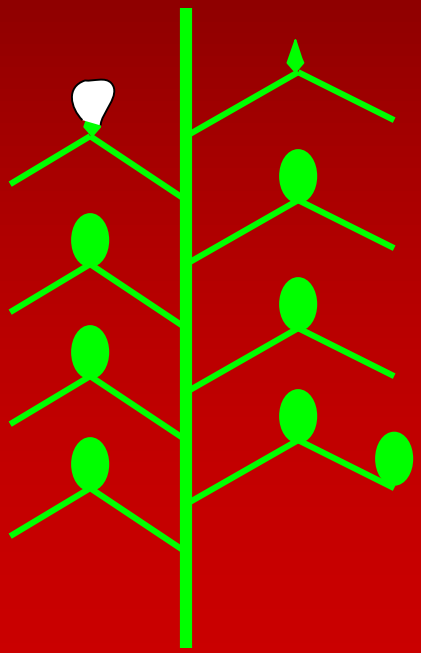

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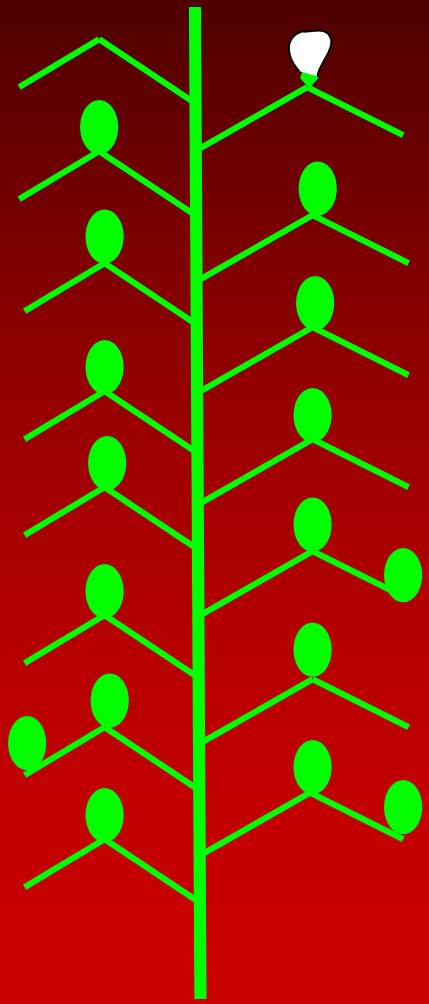

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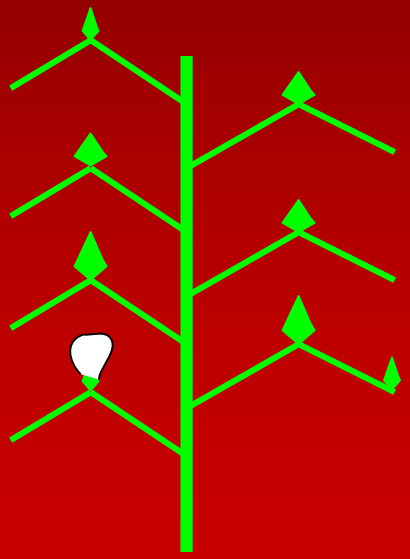
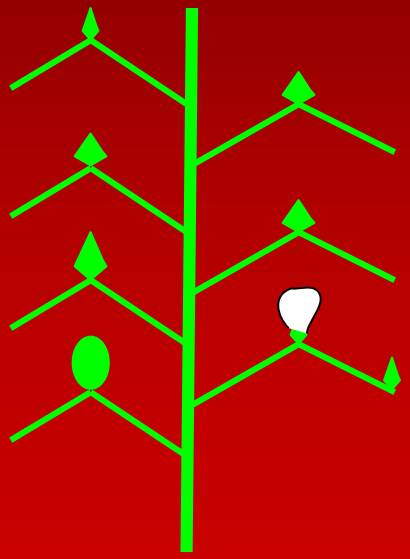
Suspended cutout



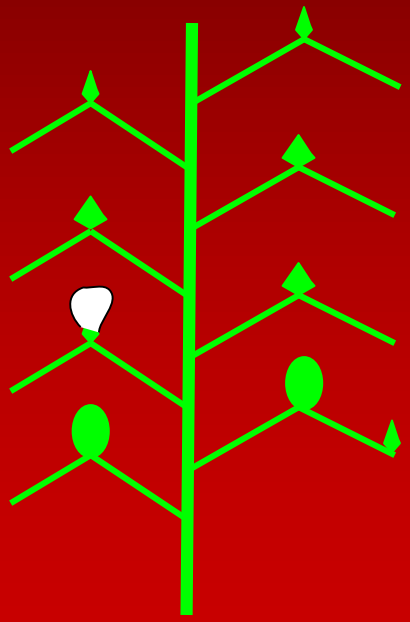
Dry prior to first bloom but wet soon after

Suspended cutout



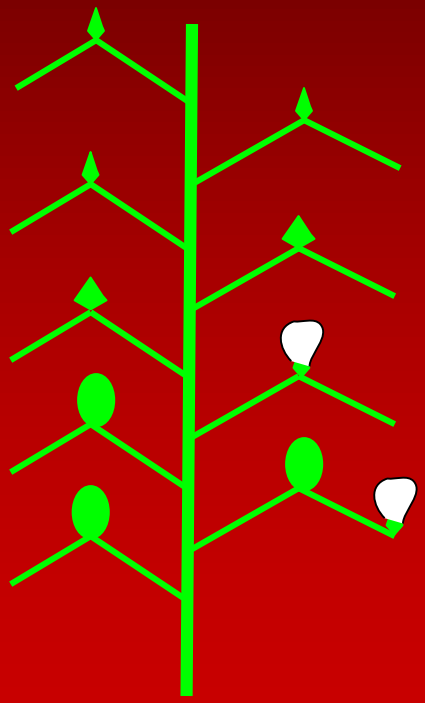
Dry prior to first bloom but wet soon after

Suspended cutout



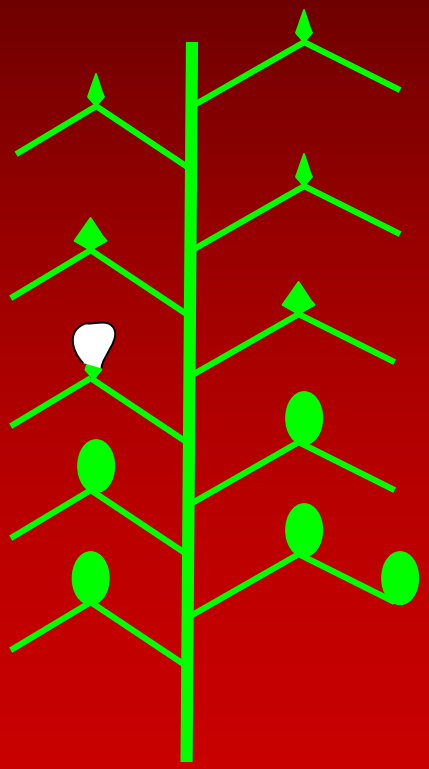
Dry prior to first bloom but wet soon after

Suspended cutout



Dry prior to first bloom but wet soon after

Suspended cutout



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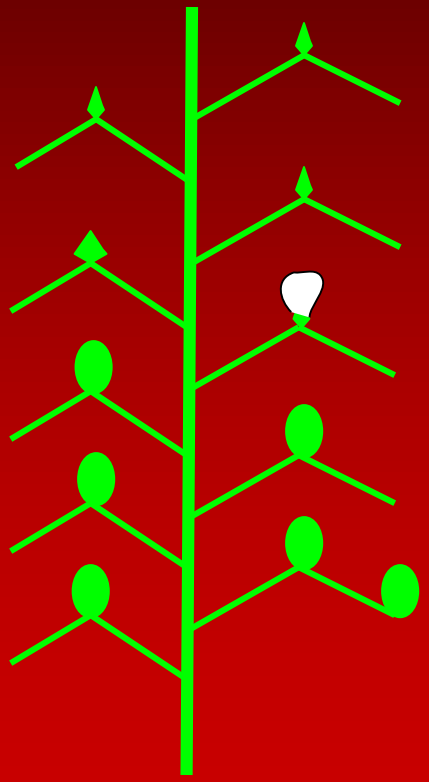
Suspended cutout



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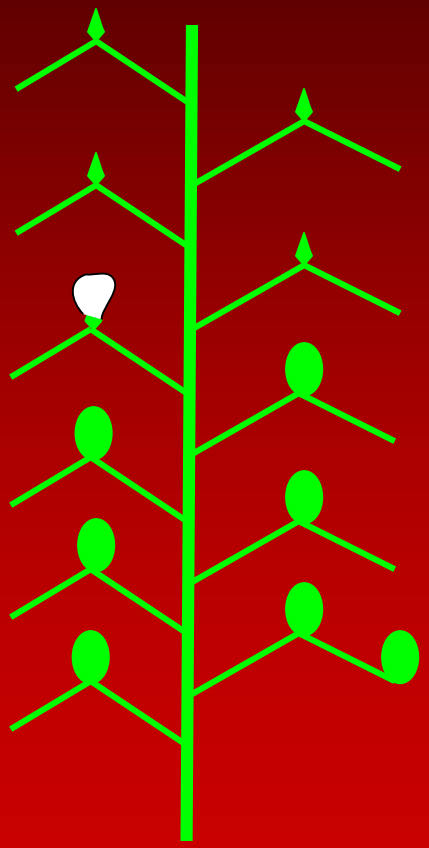
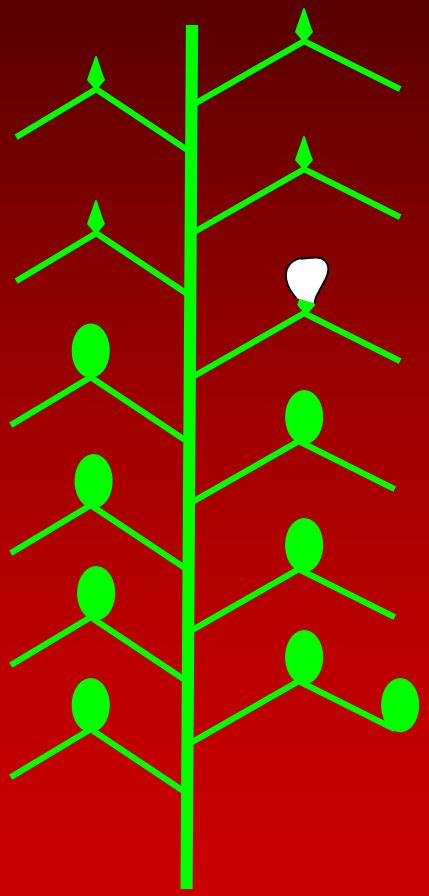
Suspended cutout



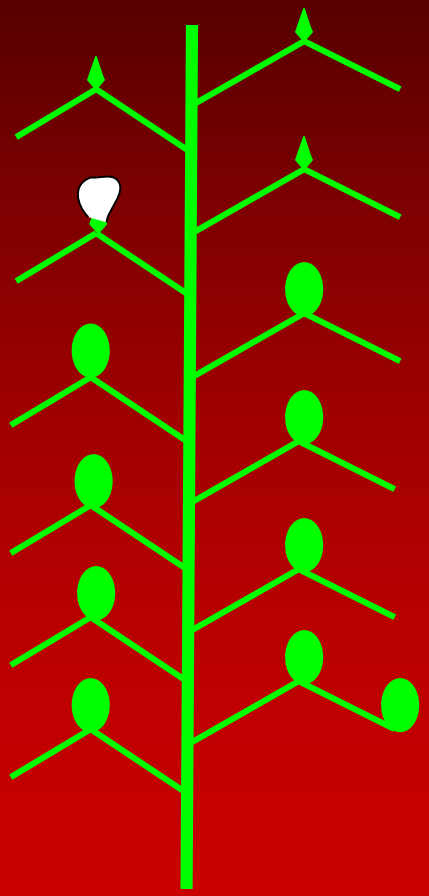
Dry prior to first bloom but wet soon after

Suspended cutout



Dry prior to first bloom but wet soon after

Suspended cutout



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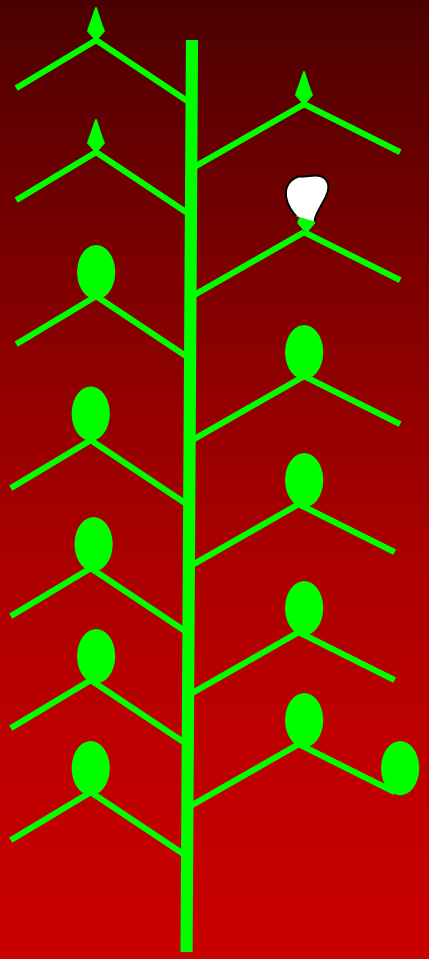
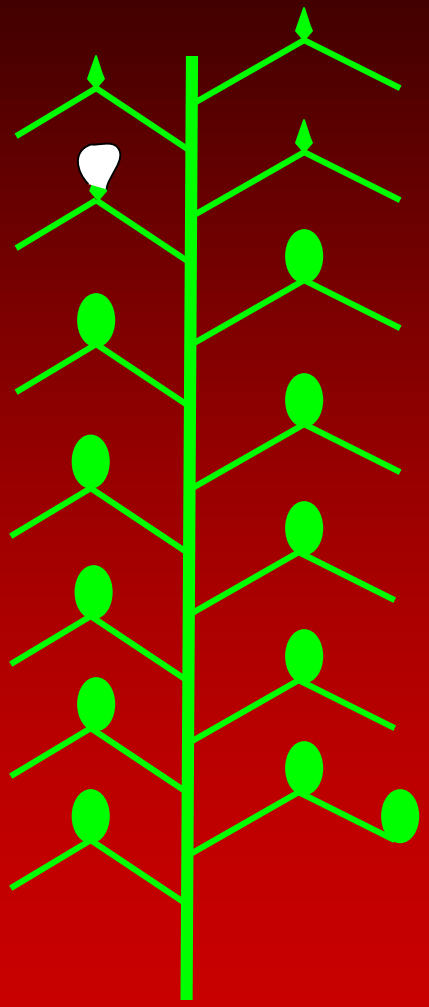
Suspended cutout



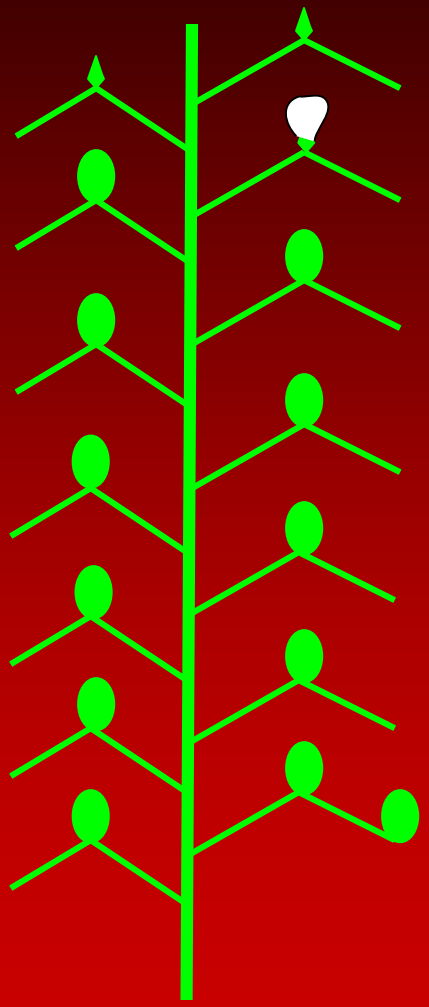
Dry prior to first bloom but wet soon after

Suspended cutout



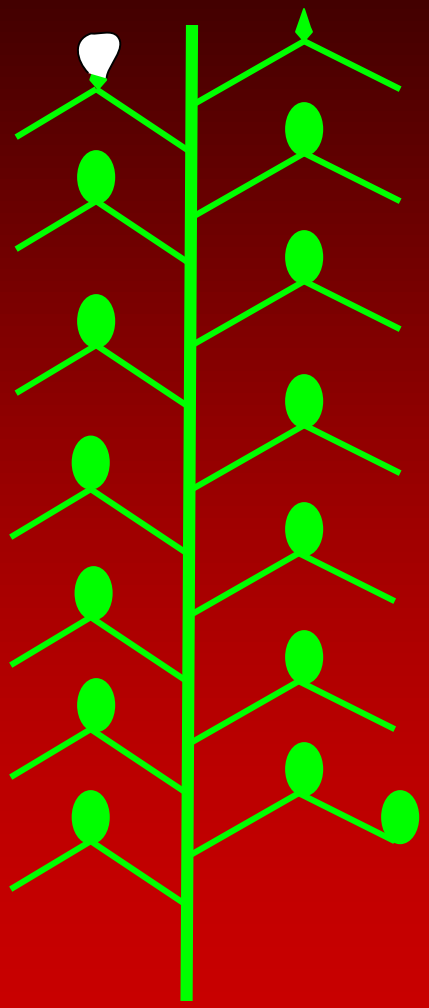
Dry prior to first bloom but wet soon after

Suspended cutout



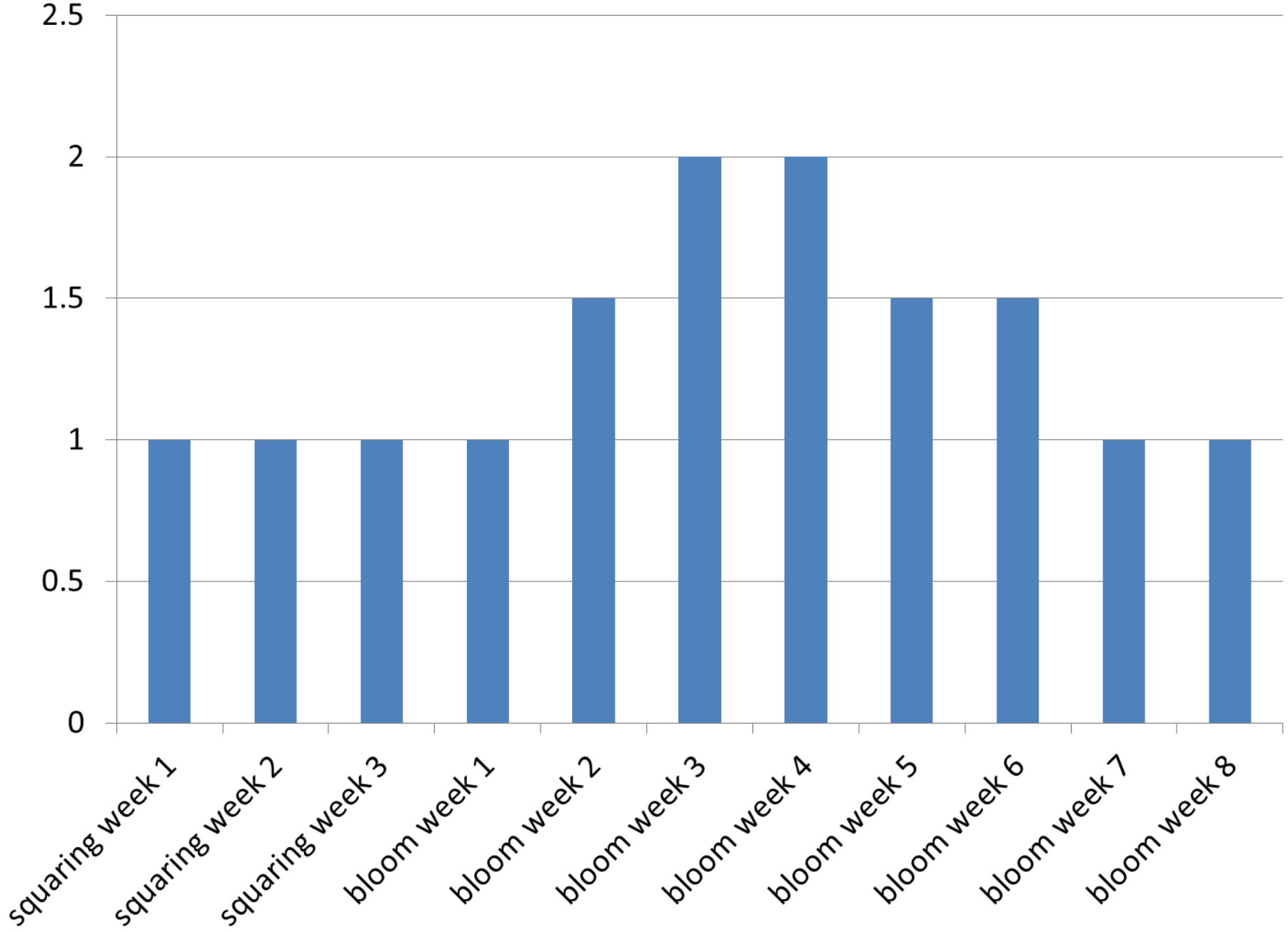
Dry prior to first bloom but wet soon after

Suspended cutout

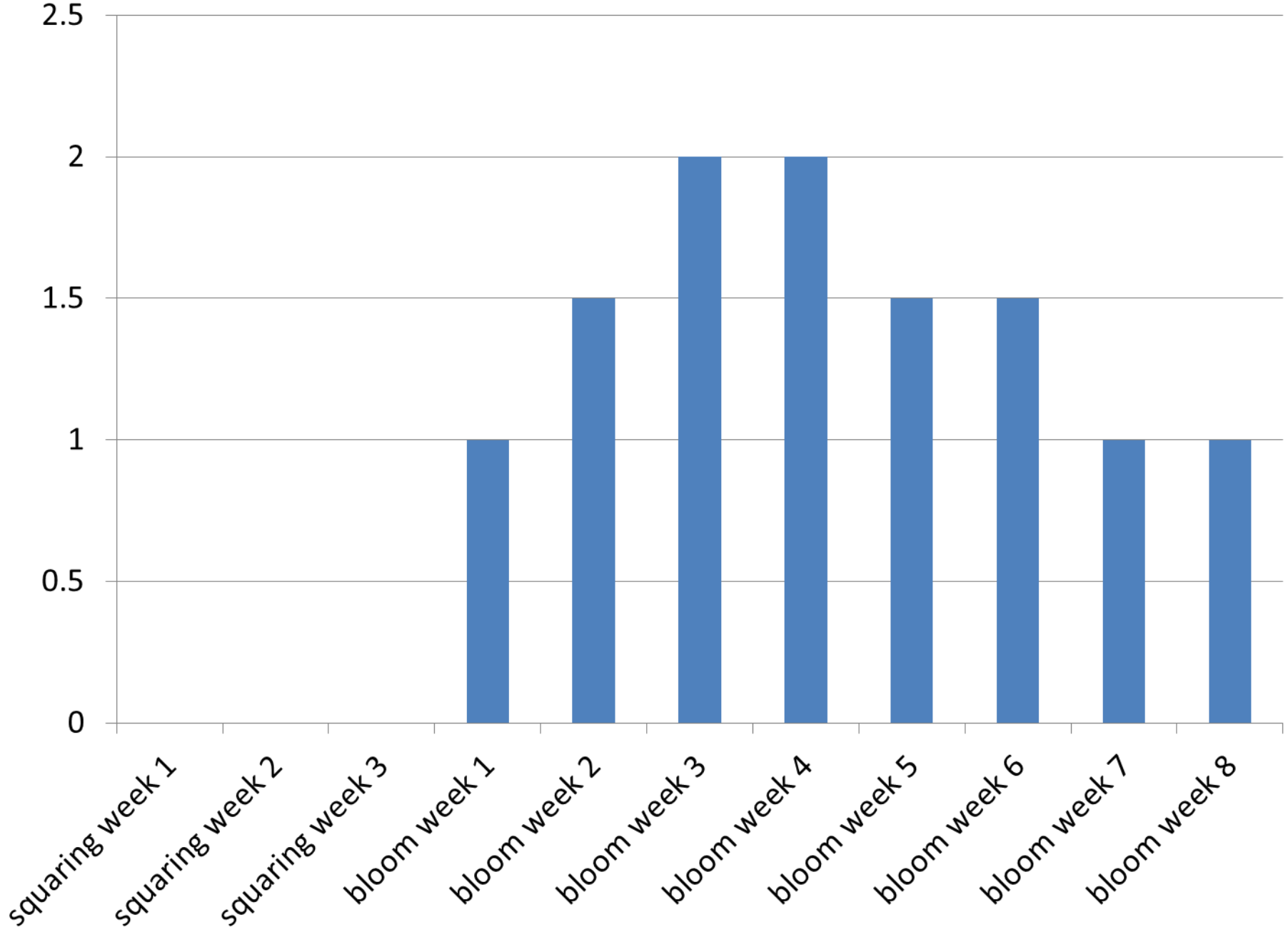


Dry prior to first bloom but wet soon after

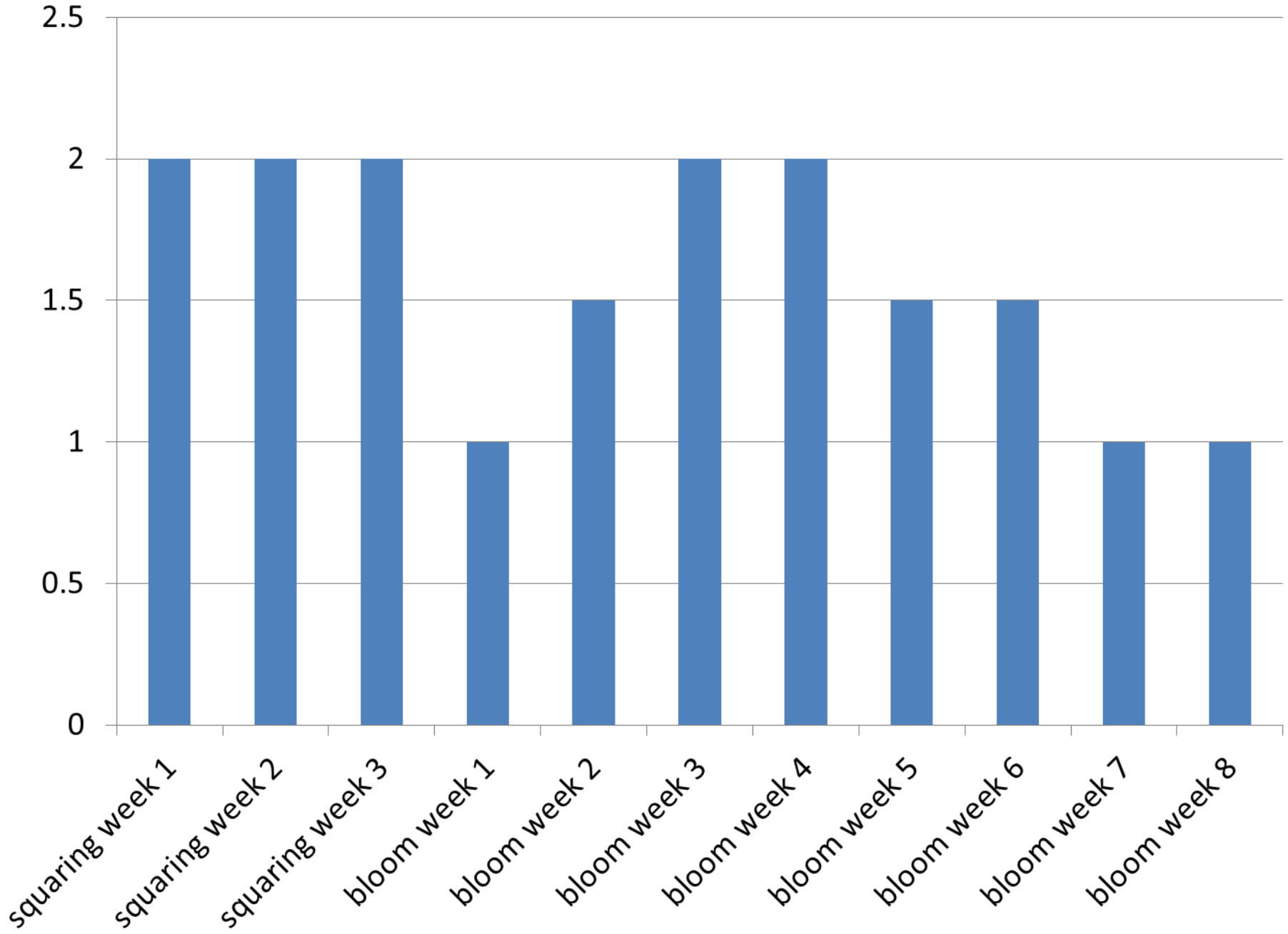
100 % UGA Checkbook (in/week)



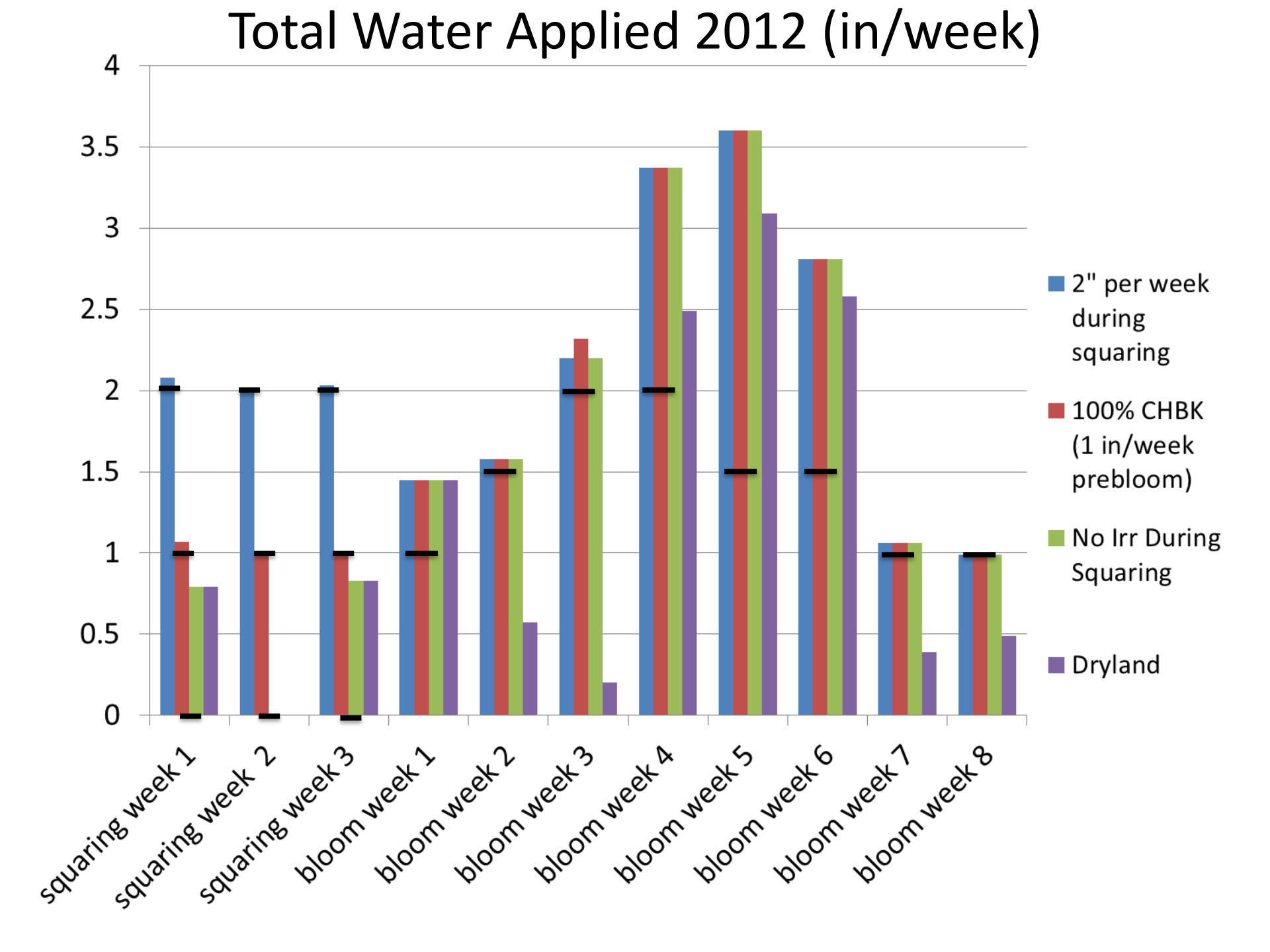
100 % UGA Checkbook (in/week) – No Irrigation During Squaring



100 % UGA Checkbook (in/week) – 2” Per Week During Squaring



Total Water Applied 2012 (in/week)



Irrigation During Squaring

FM 1944 GLB2

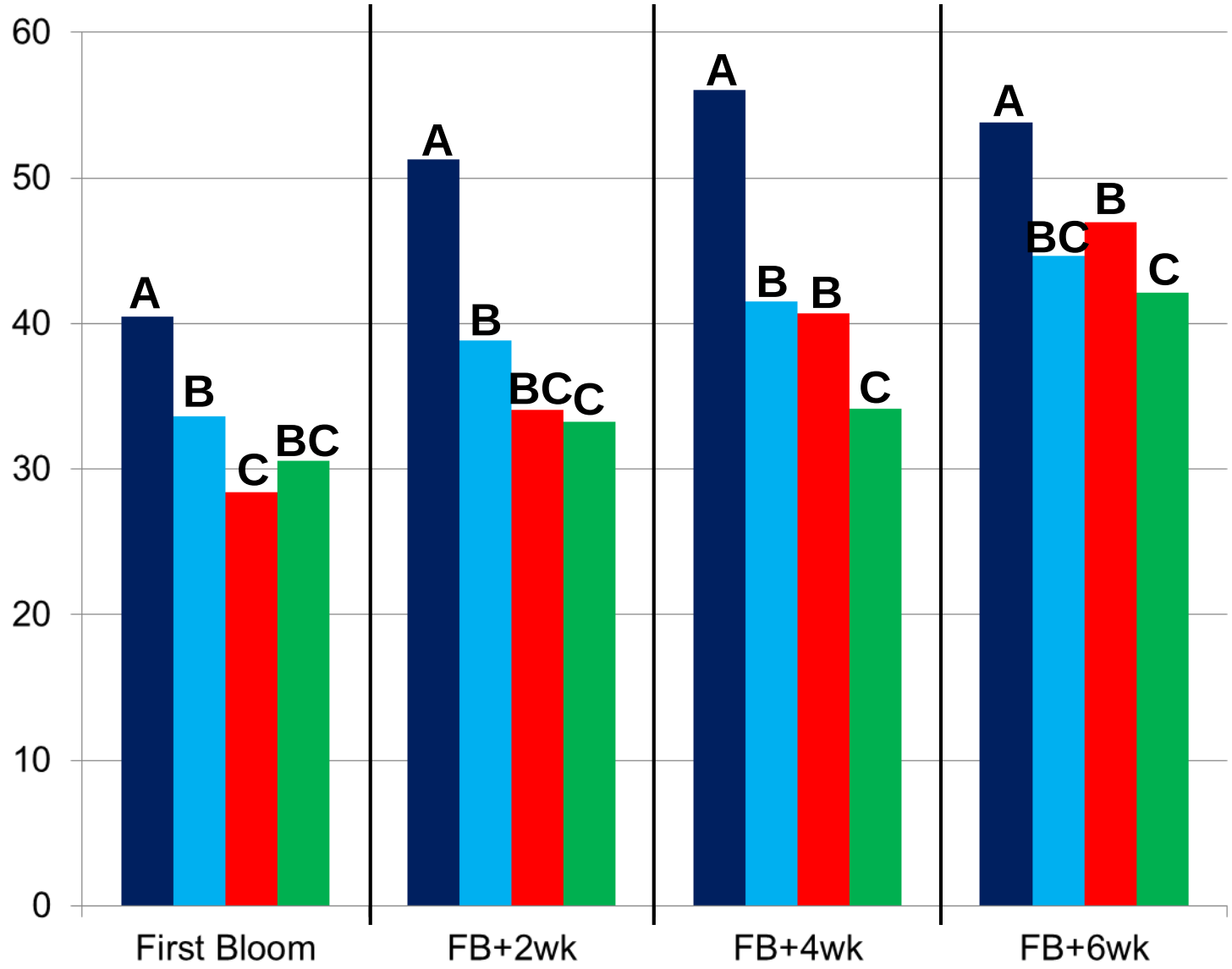
No Irr during squaring

1” per week

2” per week

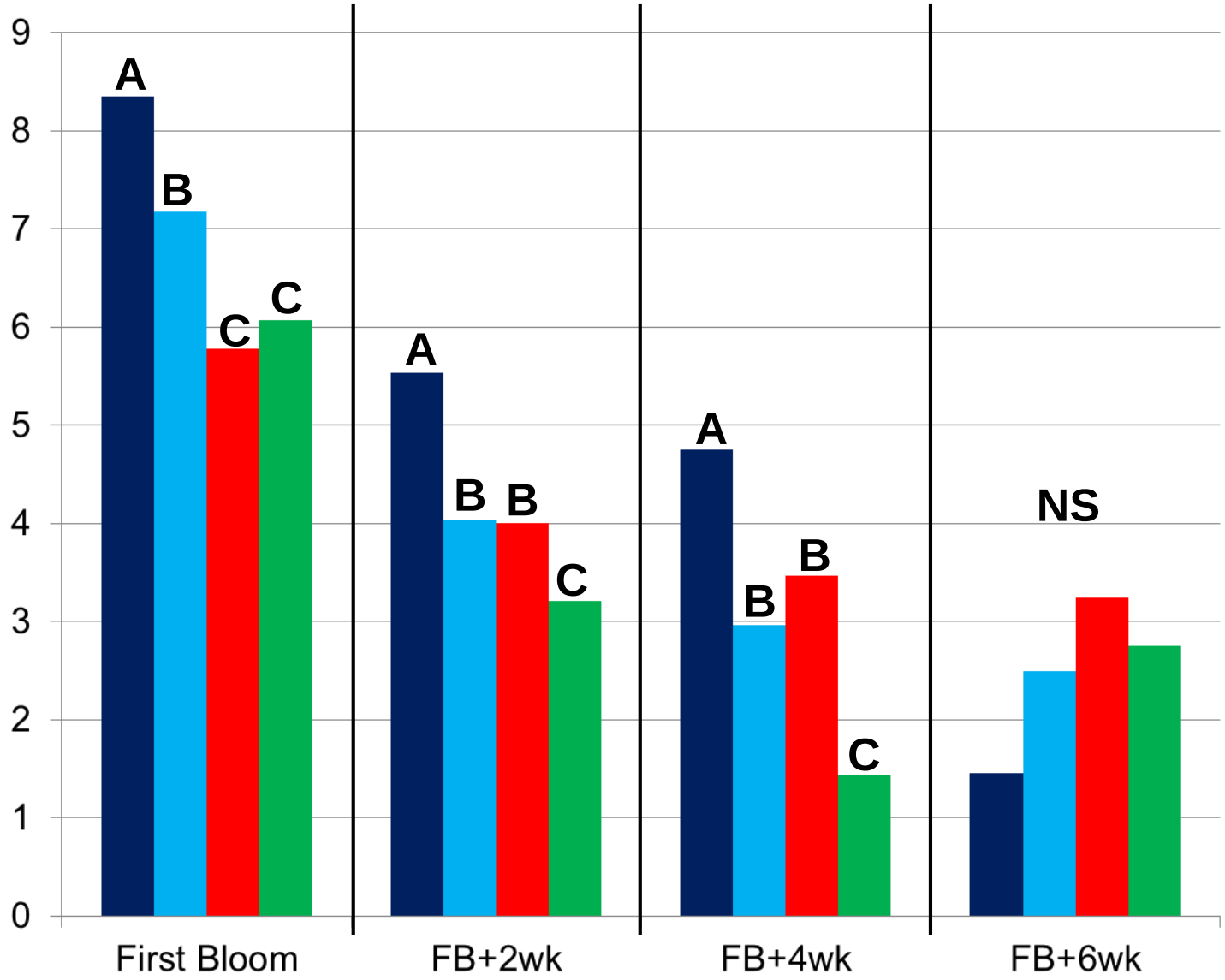
PHY 499 WRF

2012 Plant Height (in) – PHY 499



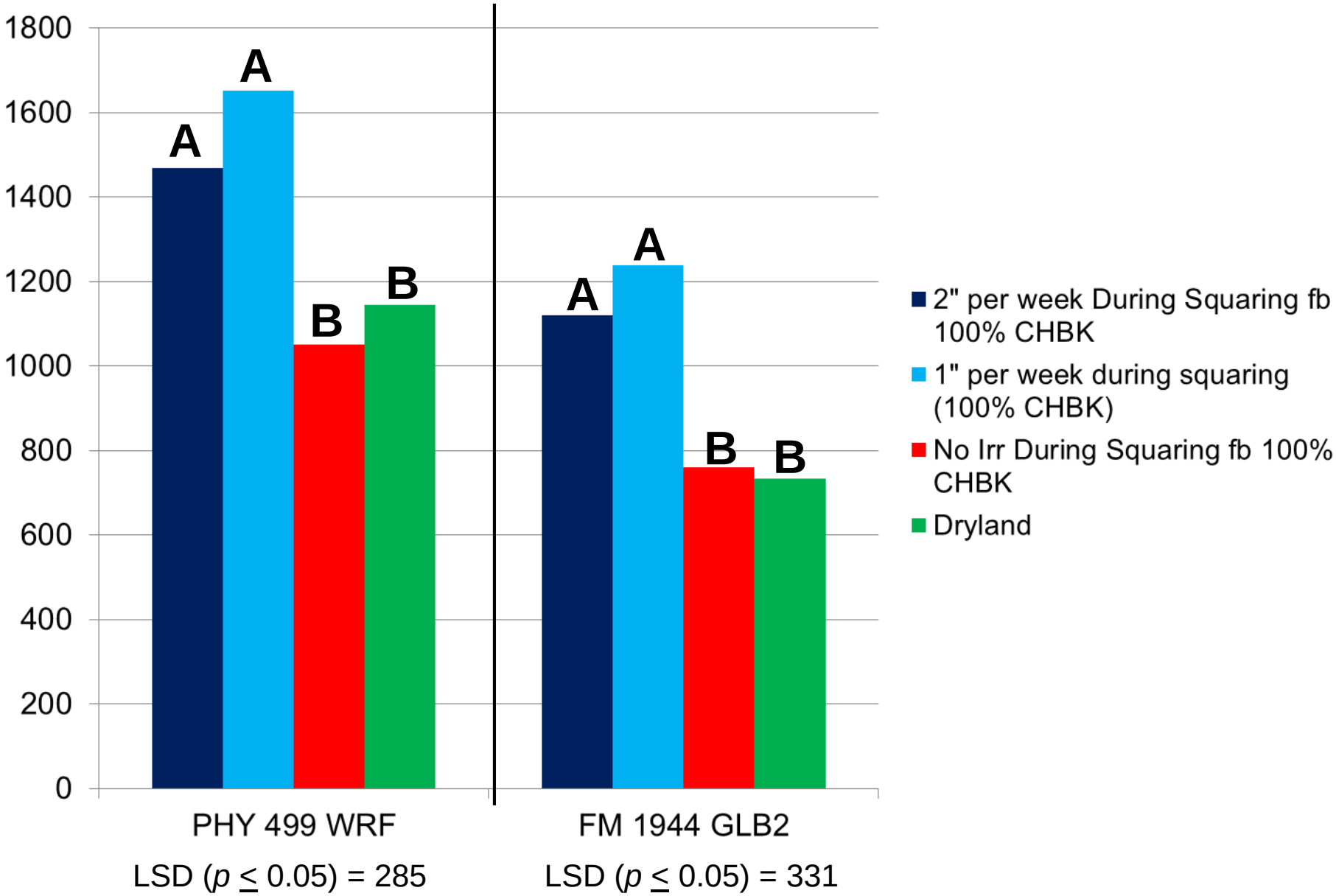
LSD ($p \leq 0.05$) =	3.6	5.04	6.29	4.77

2012 NAWF – PHY 499

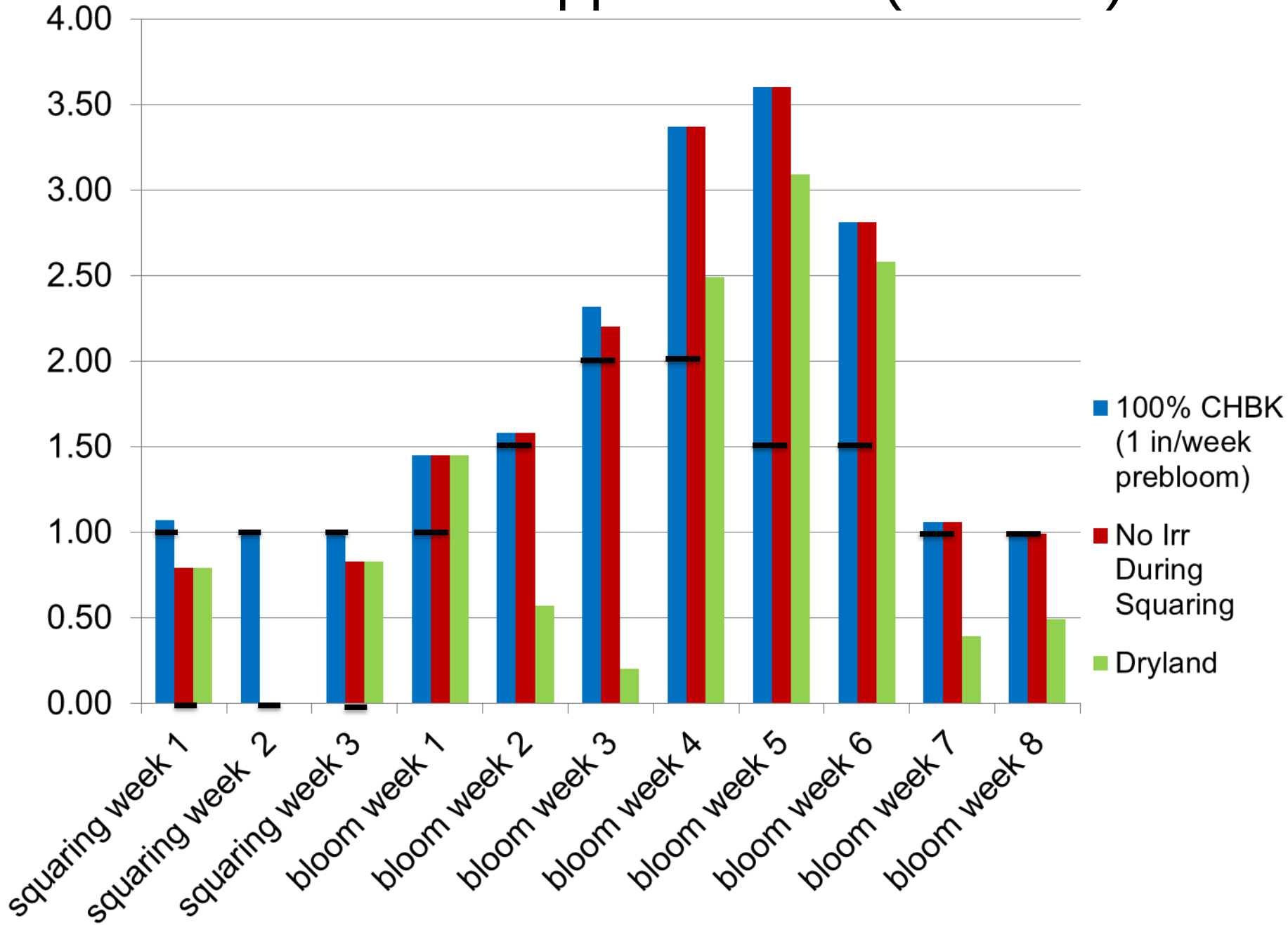


LSD ($p \leq 0.05$) =	0.54	0.72	0.99	1.72

2012 Lint Yield (lbs/A)



Total Water Applied 2012 (in/week)



Boll demands for water

lower — Water demands — higher

Peak demands = peak bloom

Demands begins to decrease once bolls reach full size

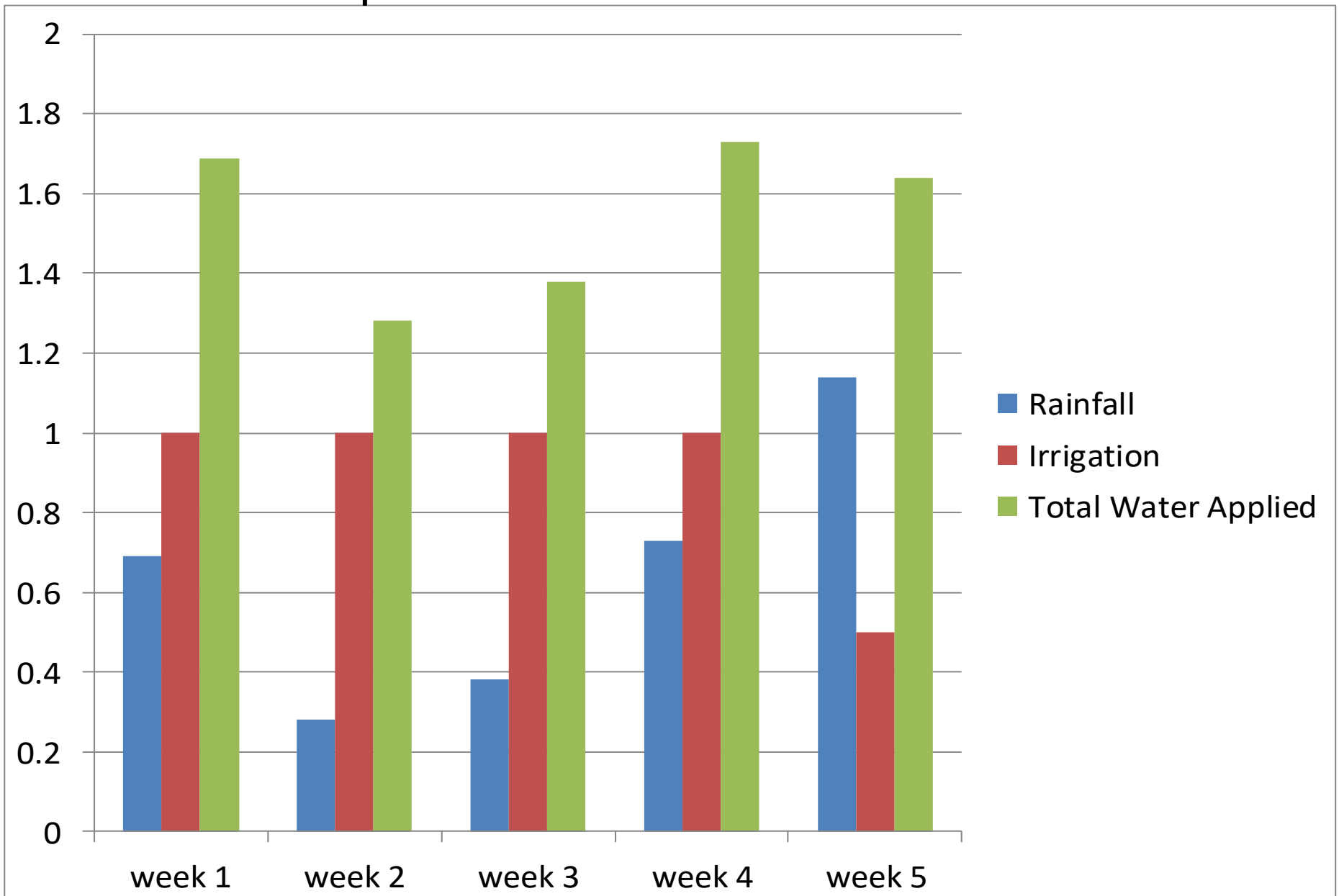
When to cease irrigation???

Chris Main, TN May 22, 2009

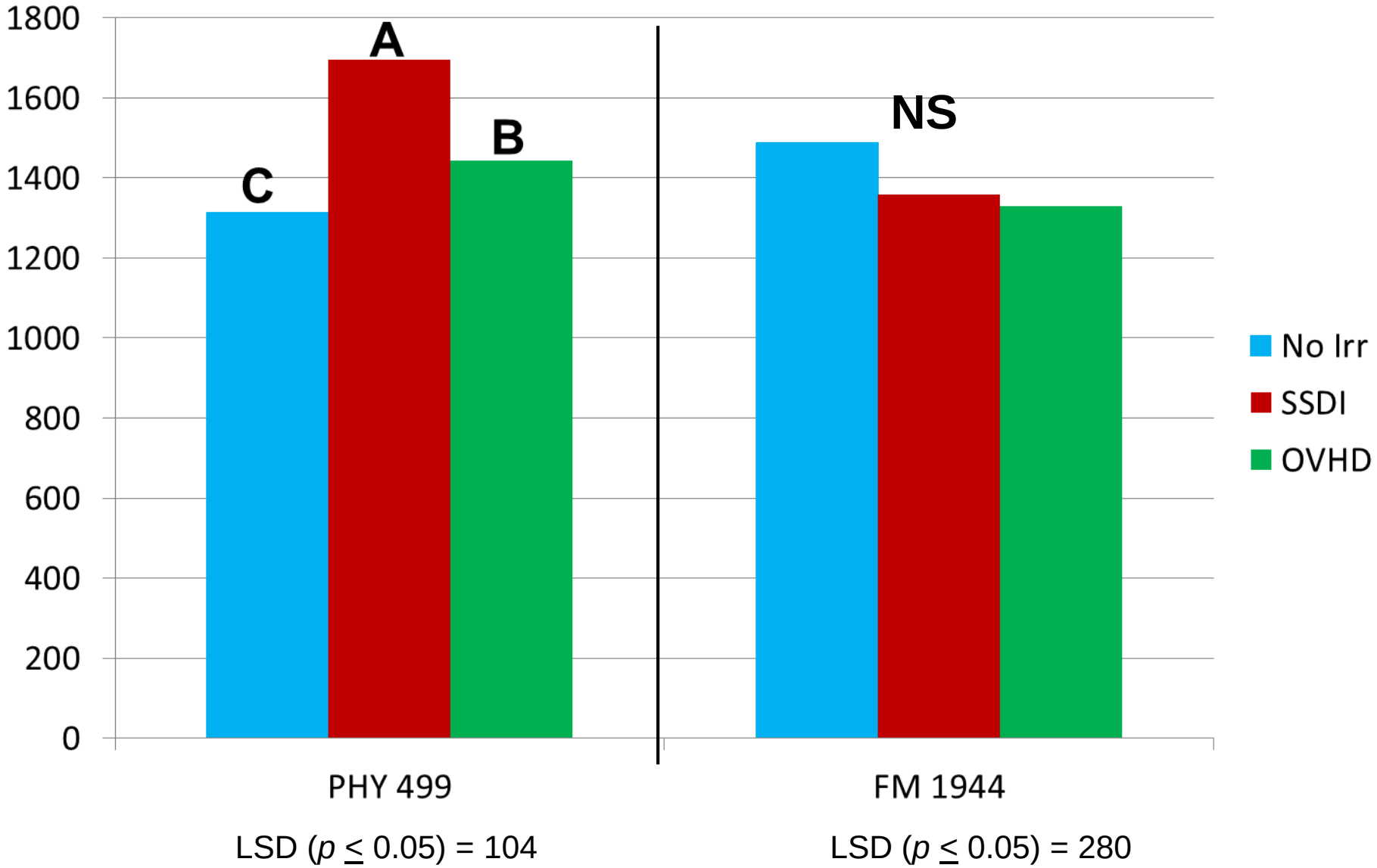
SSDI vs OVHD Beyond 1st Open Boll

- FM 1944 GLB2 & PHY 499 WRF
- Irrigated using 100% UGA Checkbook via SSDI throughout season
- Irrigation Treatments from 1st Open Boll until defoliation (regardless of rainfall)
  - None
  - 1” per week applied via SSDI in 0.5” increments
  - 1” per week applied via OVHD in 0.5” increments

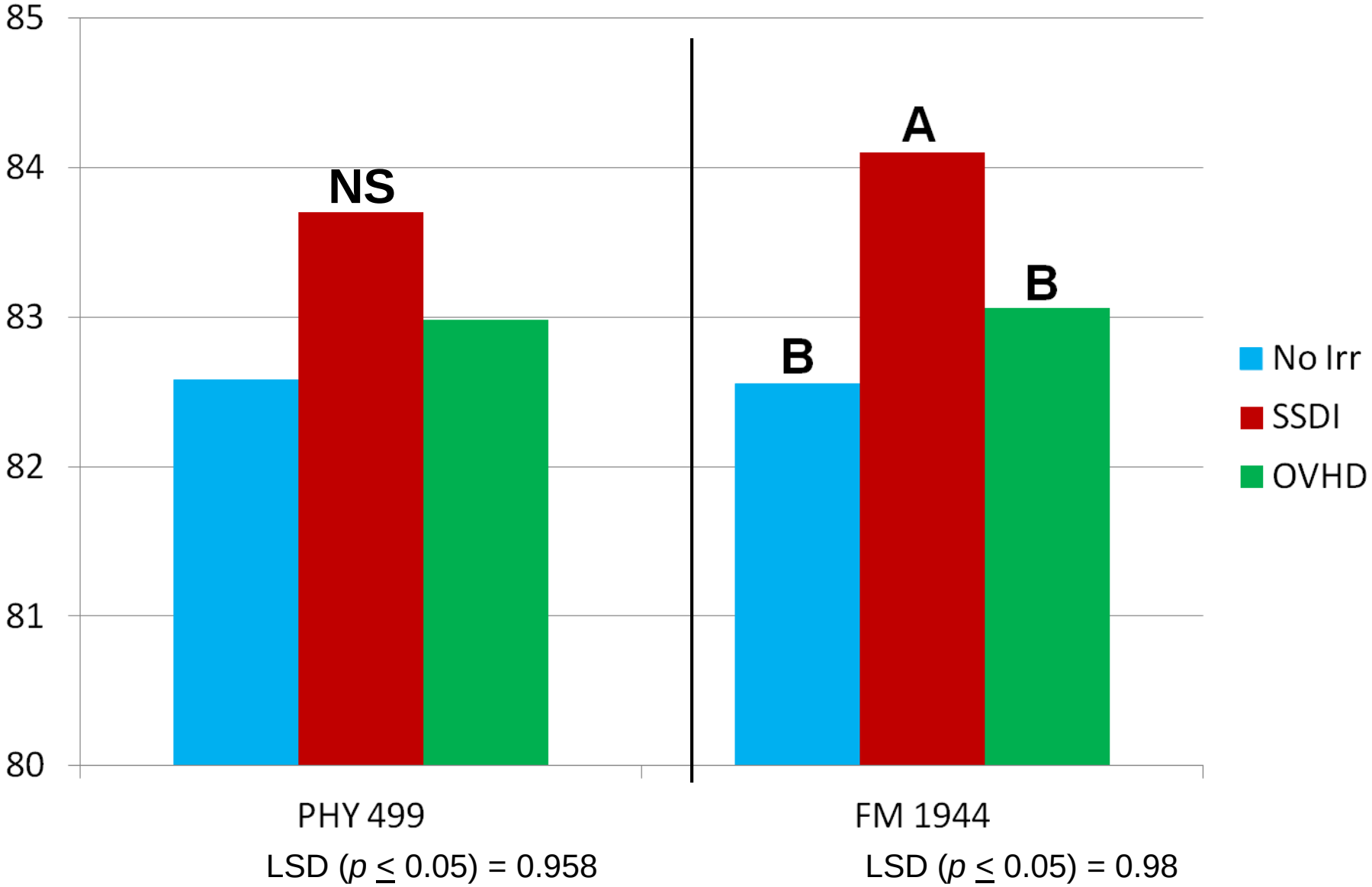
Rainfall and Irrigation (in/week) Each Week Beyond 1st Open Boll in Both SSDI and OVHD



Lint Yield (lbs/A)



Uniformity


85
84
83
82
81
80
NS
A
B
B
No Irr
SSDI
OVHD
PHY 499
FM 1944
LSD ($p \leq 0.05$) = 0.958
LSD ($p \leq 0.05$) = 0.98

Effects of excessive water during late season

Boll rot, lint mold / discoloration, regrowth, but soil water should be near field capacity to fill out bolls

Resources for You

Cotton Portal Website: http://cotton.ces.ncsu.edu/

NC Variety Calculator: https://trials.ces.ncsu.edu/cotton/

Facebook:
North Carolina Cotton
facebook.com/groups/344058599029946

Twitter:
List: NCSU Cotton
Keith Edmisten: @NCcotton
Guy Collins: @Cotton_Guy
Dominic Reisig: @DominicDReisig