Pecan Irrigation

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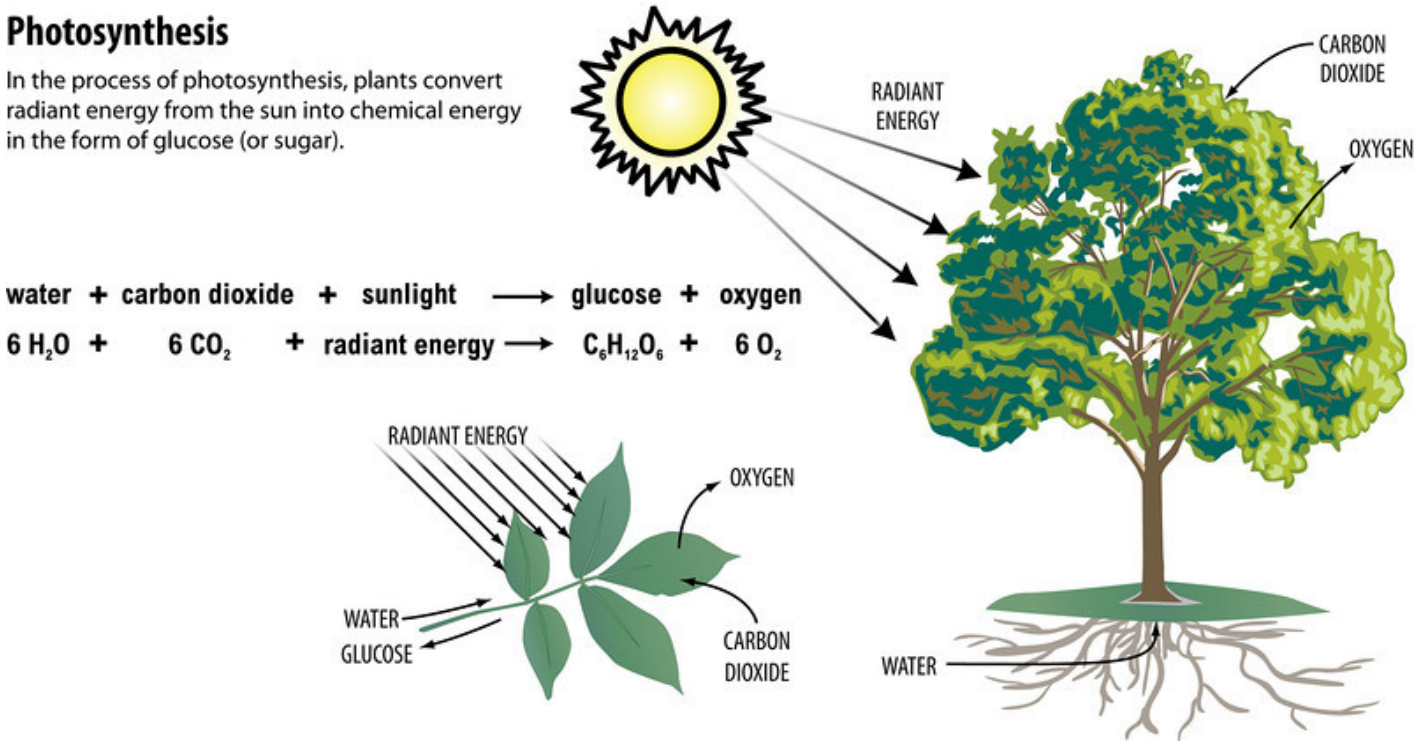
UGA Horticulture

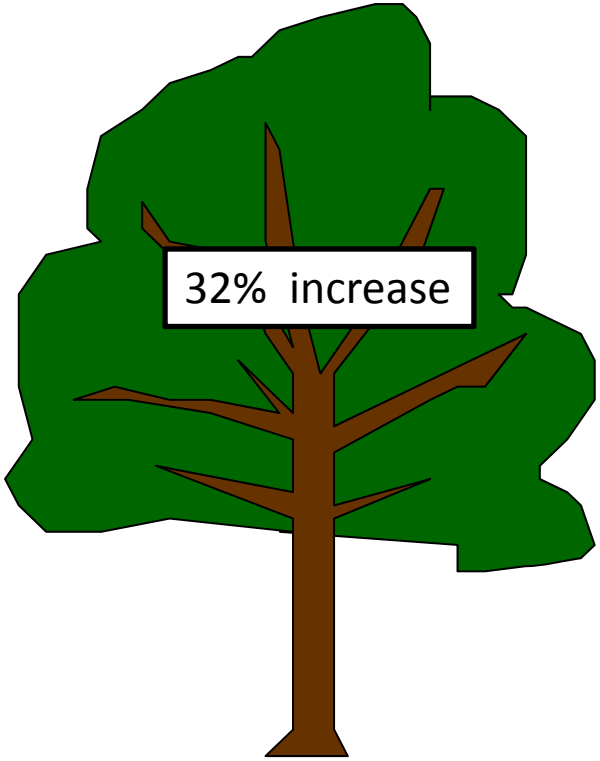
What do all plants (including pecan trees) need most?



Sunlight+Water = carbs =Tree growth and Nut Production

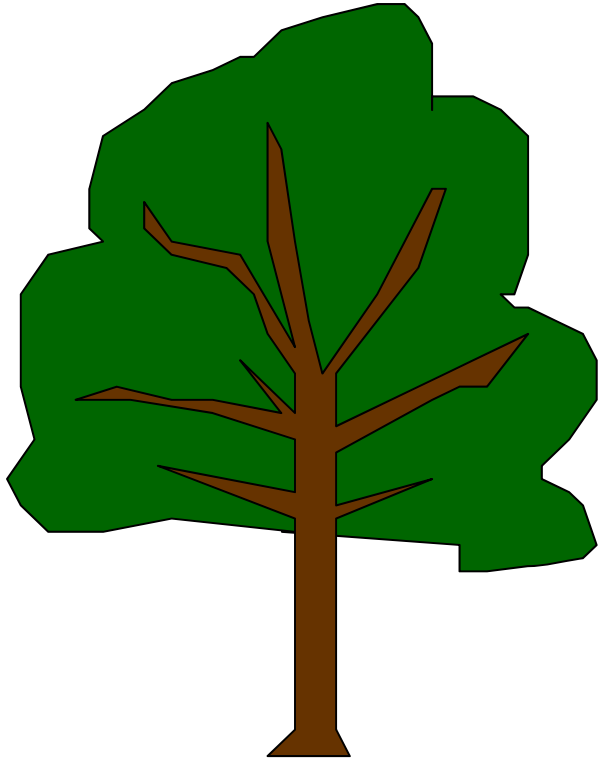
Effect of Sunlight and Air Movement on Yield---2012

OPEN



Sunlight=1843 lum/ft^2
Yield=137.4 lbs/Tree

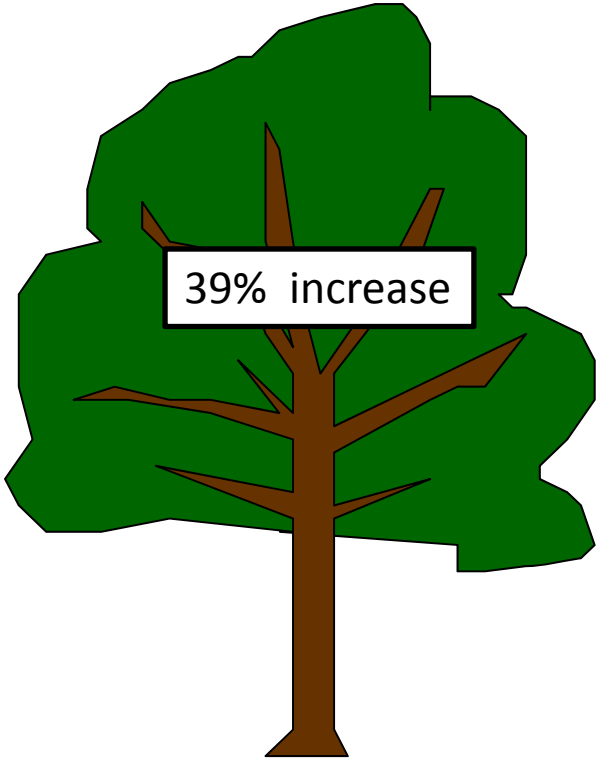
CROWDED



Sunlight=1005 lum/ft^2
Yield=93.6 lbs/Tree

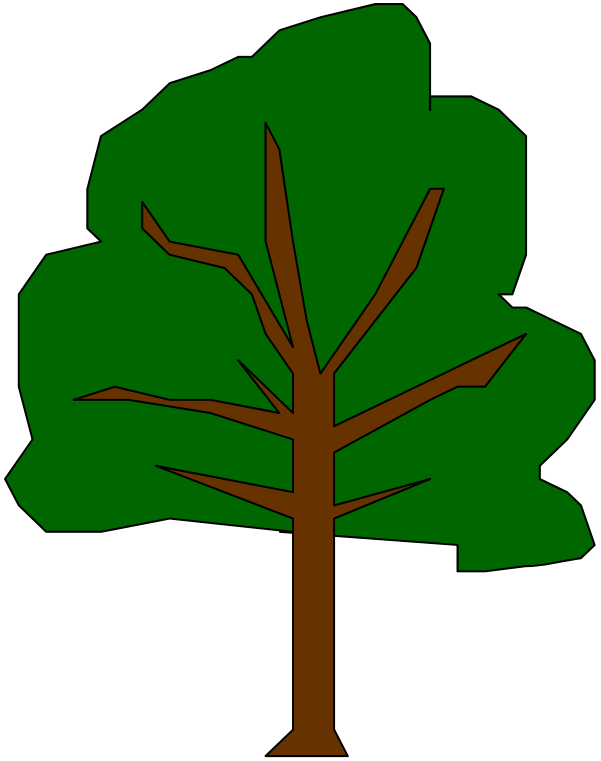
Effect of Sunlight and Air Movement on Yield---2013

OPEN



Sunlight=1176 lum/ft^2
Yield=110.6/tree

CROWDED



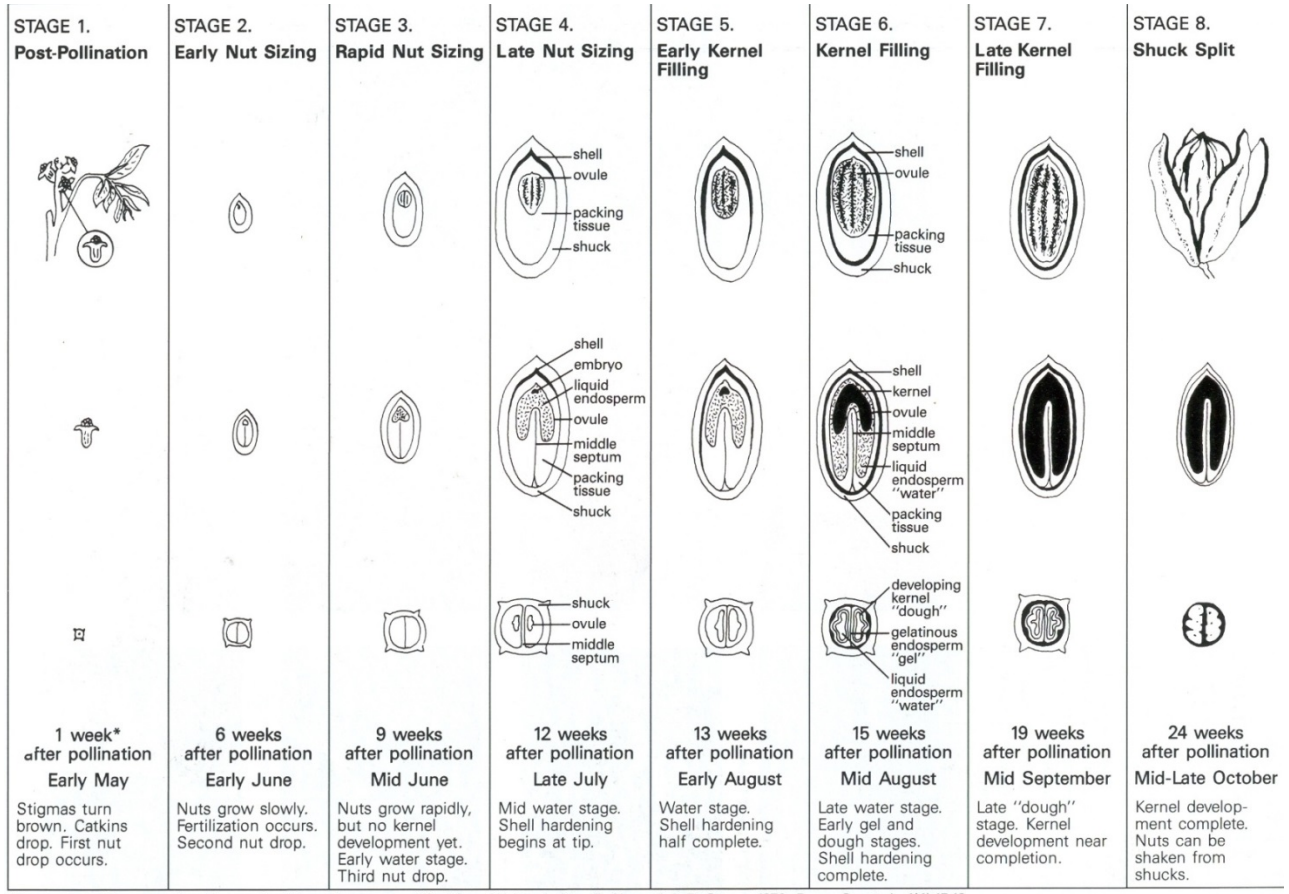
Sunlight=996 lum/ft^2
Yield=68 lbs/tree

WHEN GROWING PECANS:
IF YOU HAVE TO CHOOSE BETWEEN WATER AND FERTILIZER……

CHOOSE WATER!

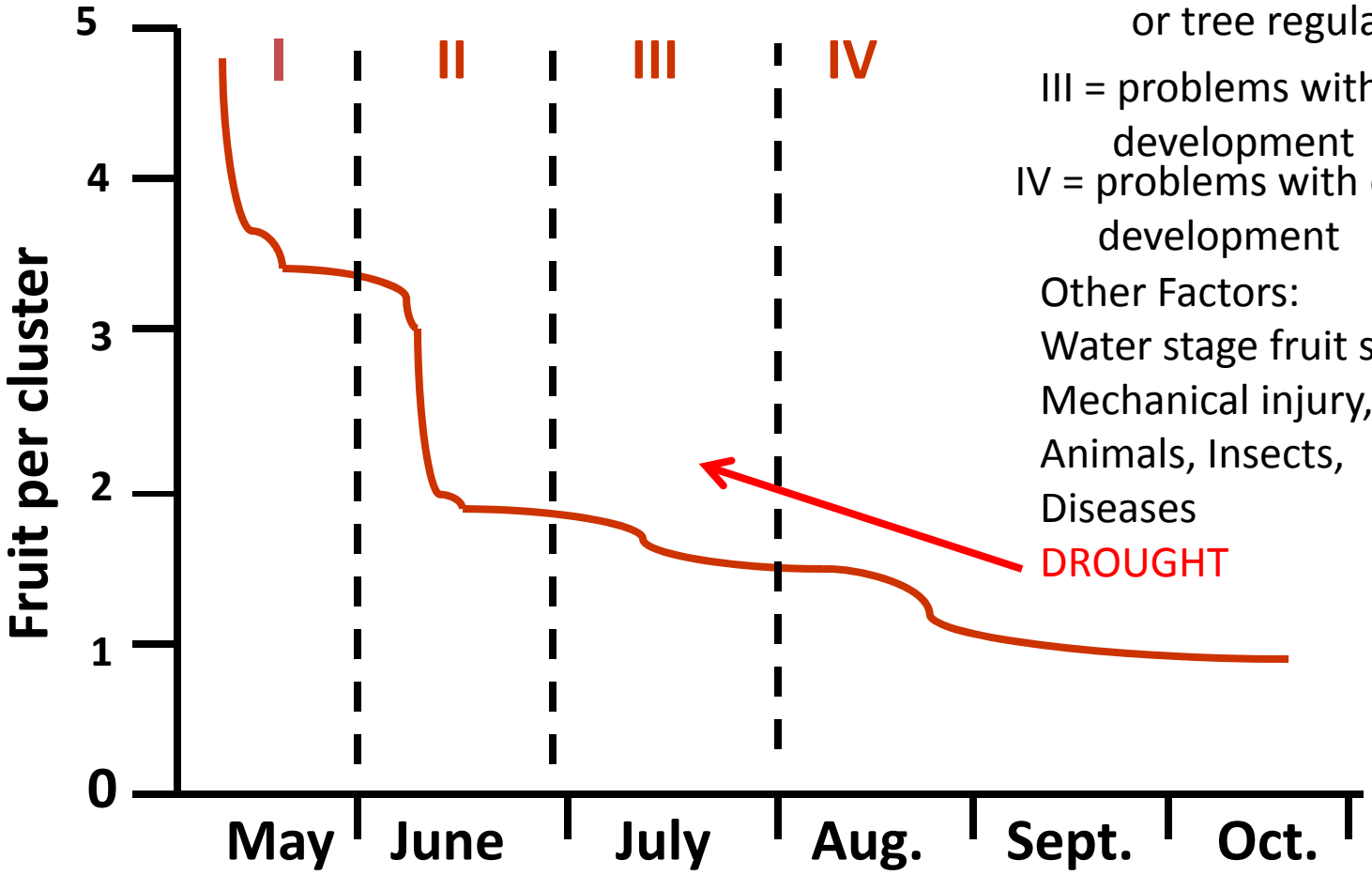
And Remember: Its not how much you water, but when

What happens to pecans when drought occurs:



*Dates vary with season, location, and cultivar. Diagrams modified from Wolstenholme, B. N., and J. B. Storey, 1970. Pecan Quarterly 4(4):15-19.

Fruit-drop Pattern



I = weak flowers, low energy reserves

II = lack of egg fertilization or tree regulated

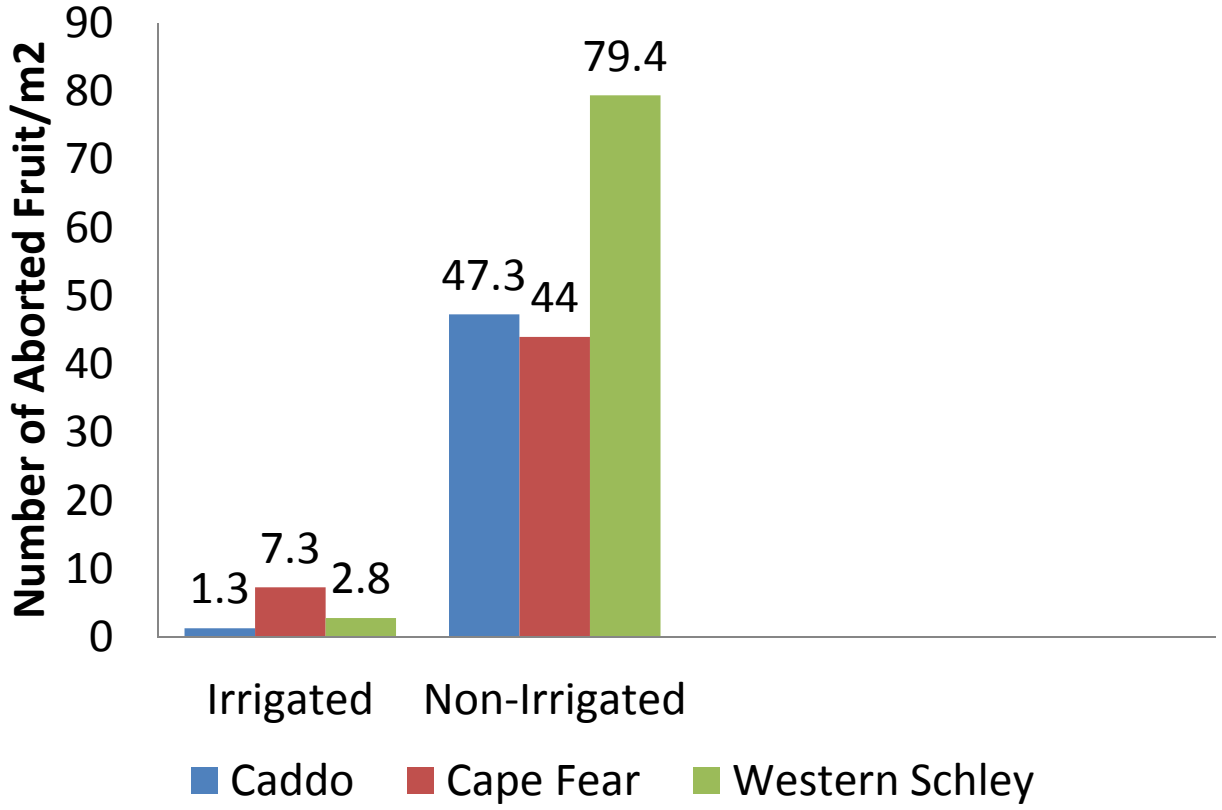
III = problems with endosperm development

IV = problems with embryo development

Other Factors:
Water stage fruit split,
Mechanical injury,
Animals, Insects,
Diseases
DROUGHT

Nut Sizing

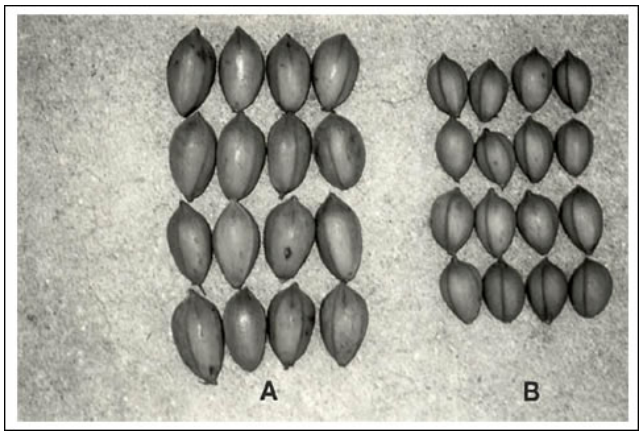
July Drought Results in Greater Fruit Abortion



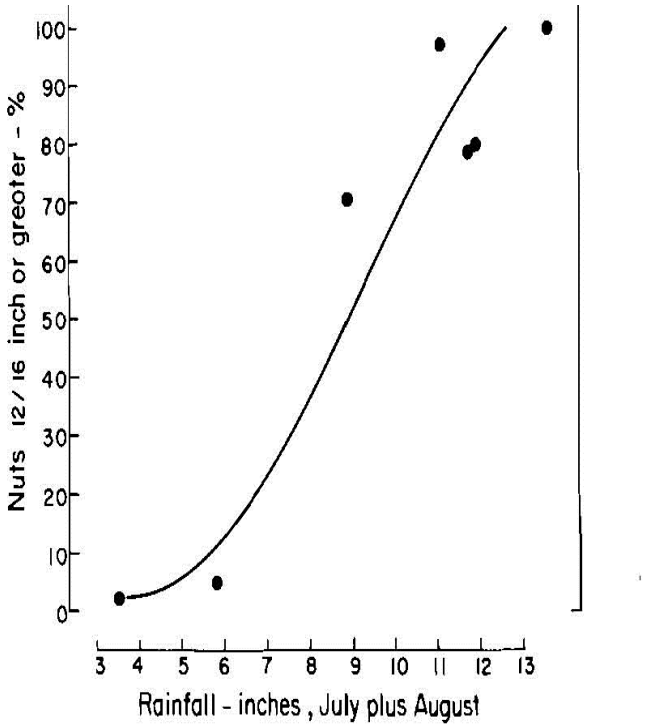
Sparks, 1989

September drought---leaf abcission/poor kernel filling

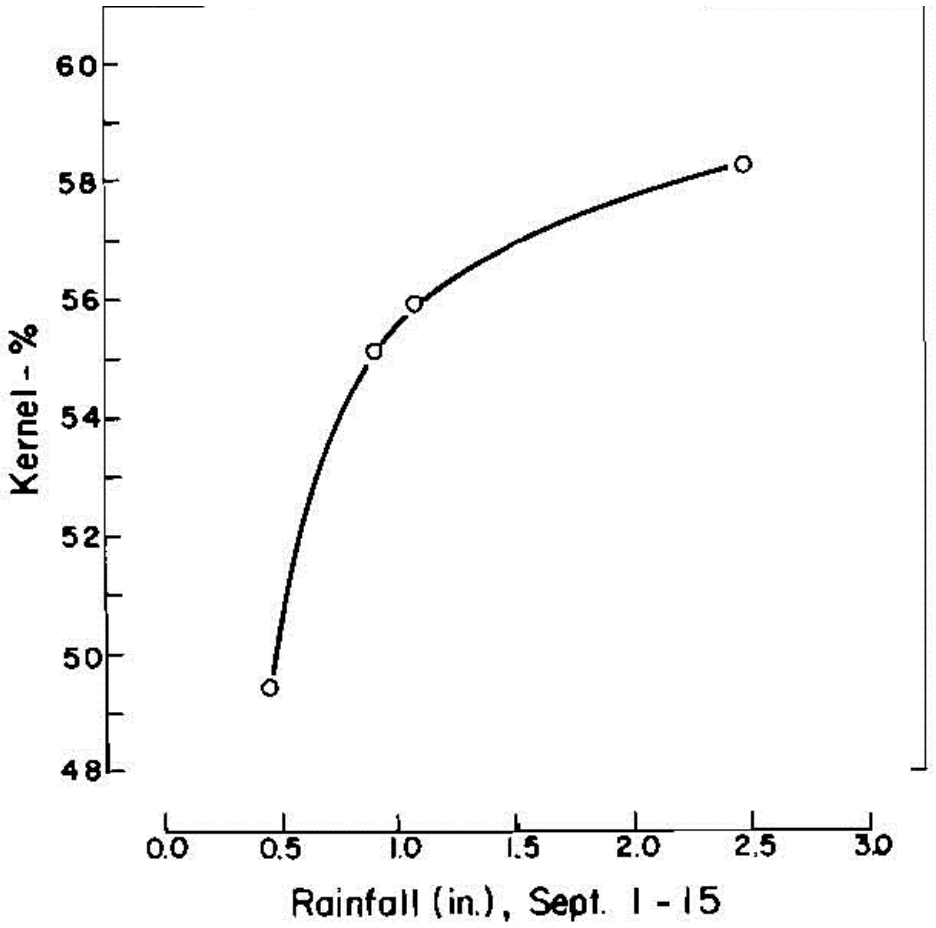
Effect of Drought During Nut Sizing



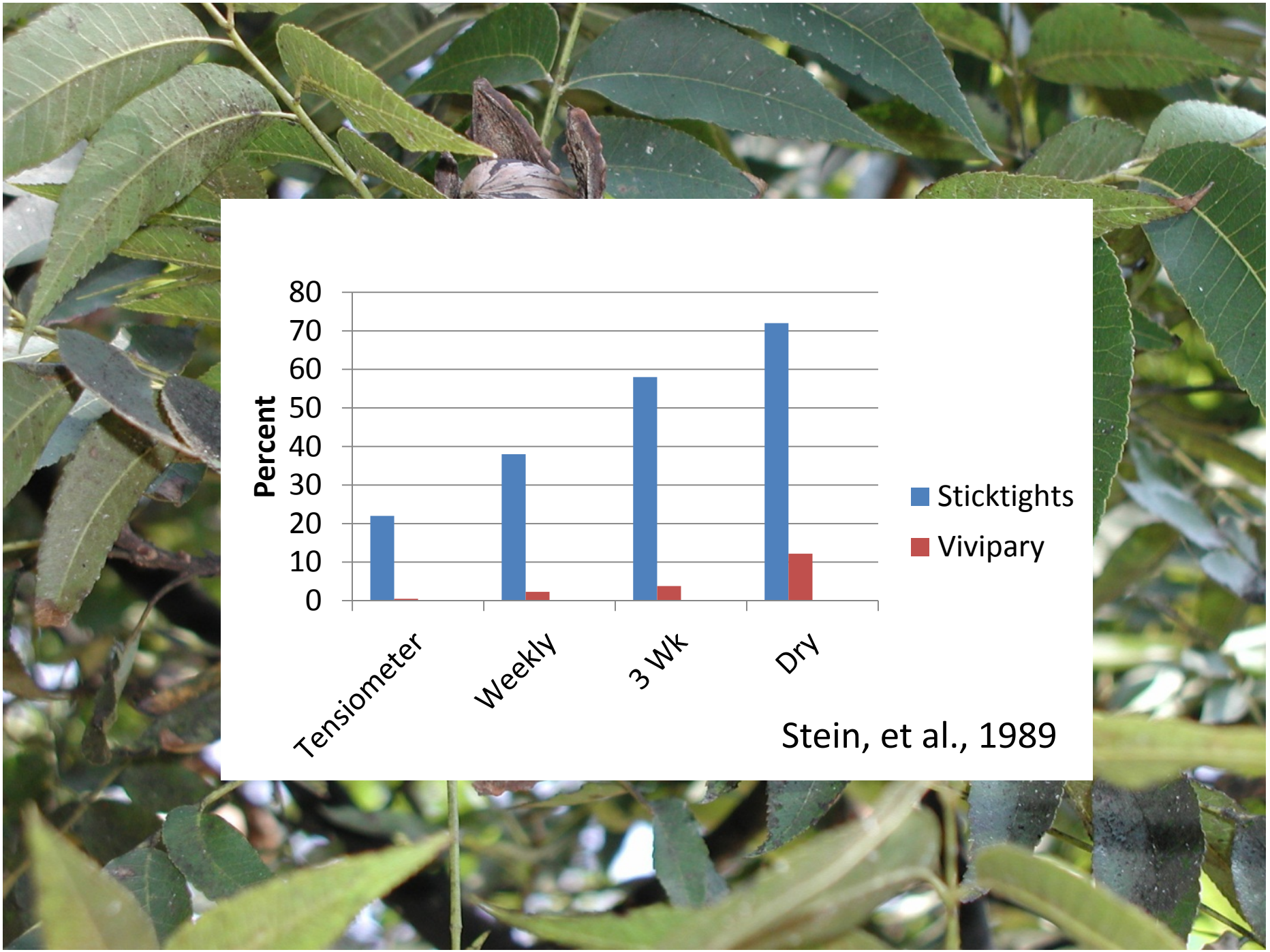
A=Irrigated
B=Non-irrigated

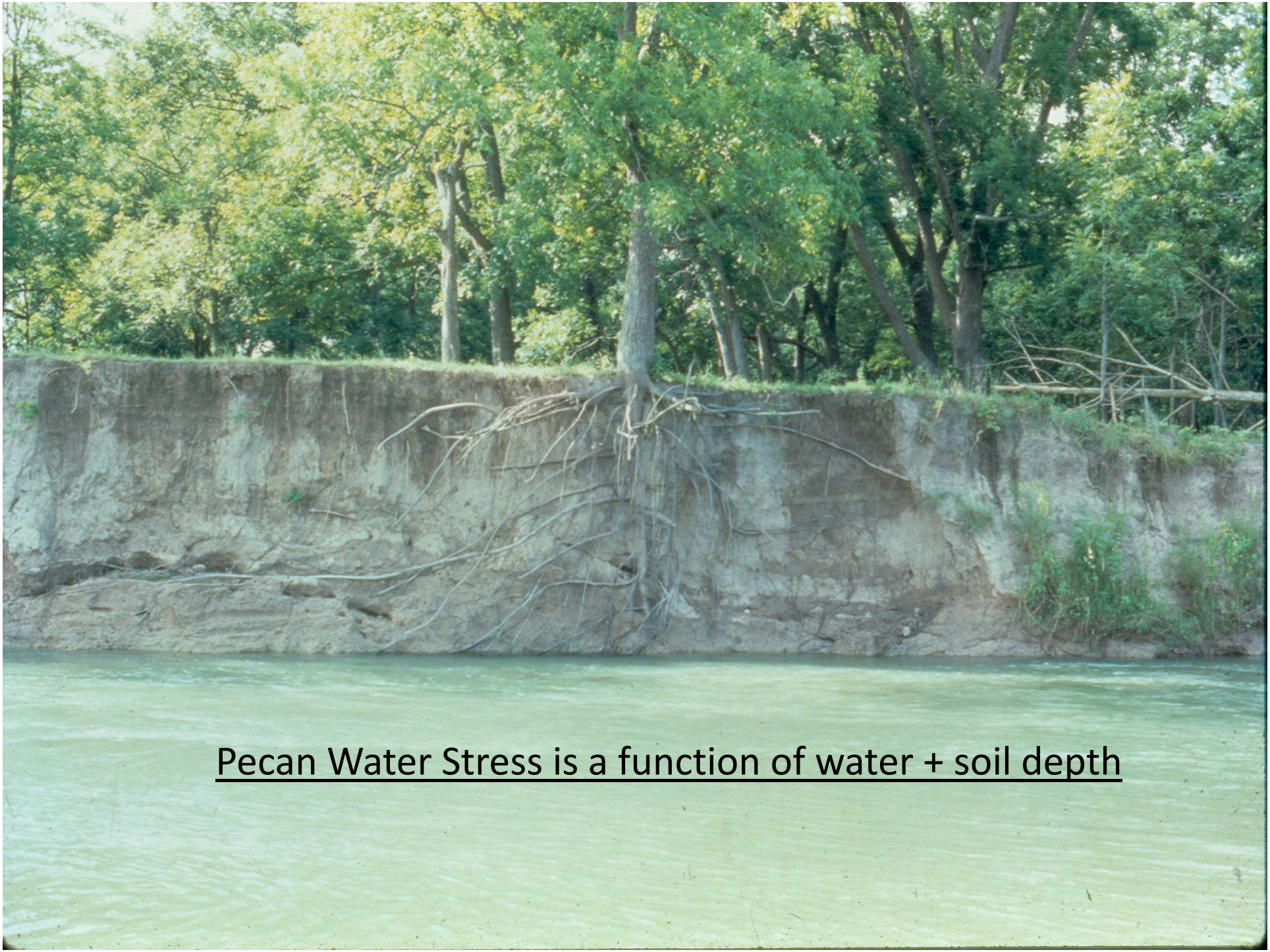


Effect of Drought During Kernel Fill

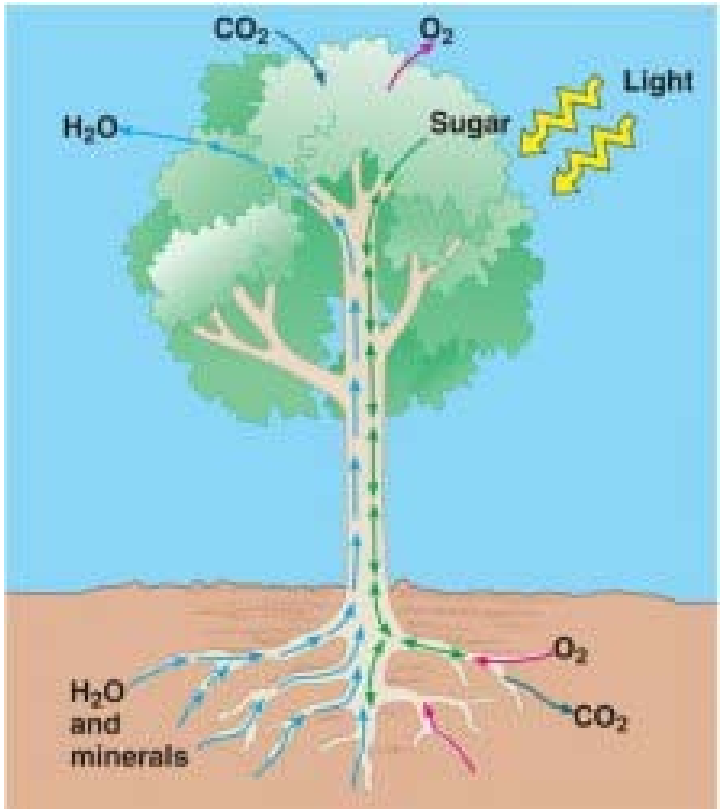


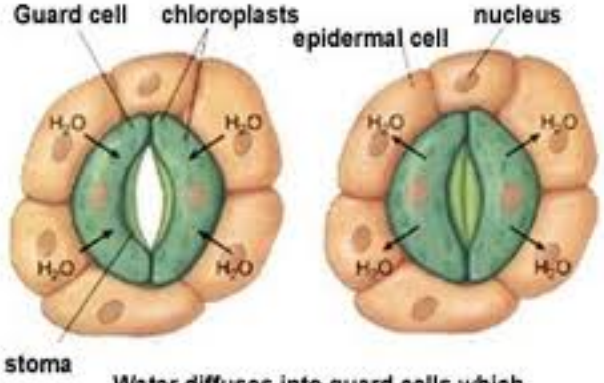
Sparks, 1992


Percent
80
70
60
50
40
30
20
10
0
Tensiometer
Weekly
3 Wk
Dry
Sticktights
Vivipary
Stein, et al., 1989


Pecan Water Stress is a function of water + soil depth

How Do Pecan Trees Use Water?





Water diffuses into guard cells which causes them to open. On hot/dry days, the guard cells have less water, they relax and the stoma close

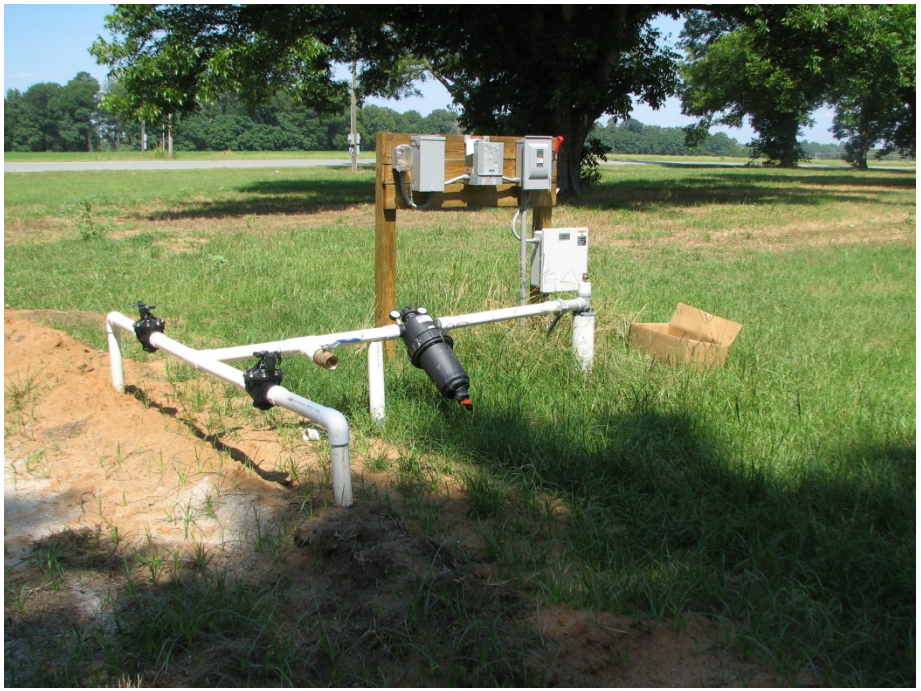
Pecan Water Use

- Pecans extract most of their water from the upper 32 inches of the soil profile
- Need 60” of water per year
  - In the SE, rainfall can account for 50-67% of needs
- Pecan trees can use as much as 350 gal/day
- Greatest demand is during August/September
- Pecan Irrigation systems are designed to be supplemental to rainfall
- At 12 trees per acre, Drip/Microjet system capacity should be 3600-4200 gallons/acre/day

Costs of Drip Irrigation

- System Parts and Installation: $800 per acre
- Well & Pump: 4” + 5 hp = $7800

  6”+30 hp = $34,000
- Operation Cost: $40-$60 per acre



Value of Fertilizer

Fertilizer Rate (lbs/acre)	Yield/Acre (lbs)	% Increase	Value of Increase (@$1.34/lb)
0	1696	0	0
400 lbs biennially	1837	8.3	188.94
400 lbs annually	2211	30	690.10
800 lbs annualy	1577	-7.0	-159.46

'Stuart'

Worley, 1974

Value of Irrigation

Water Application (Gal/Day/Acre)	Yield/Acre (lbs)	% Increase	Value of Increase (@ $1.34/lb)
0	1034	0	0
1200	1374	32	455.60
3600	1761	70	974.18

'Stuart'

Daniel, J.W. 1982

Return on New Irrigation System
Example: 25 acre orchard

Assumes $1.34/lb.

- Cost of new irrigation system: $27,800
- Value of increase in production: $974.18/acre X 25=$24,354.50
- 27800-24354.50=$3445.50 left to recover in year 2

- ***At $2.00/lb, the value of the increase is $1454/acre***
- ***$1454X25=$36350***
- ***36350-27800=+8550***

Return on New Irrigation System
Example: 100 acre orchard

- Cost of new irrigation system: $114,000
- Value of increase in production: $974.18/acre X 100=$97,418.00
- 114,000-97418= -$16,582

At $2.00/lb:

$145,400-114,000=+$31,400

Assumes $1.34/lb.

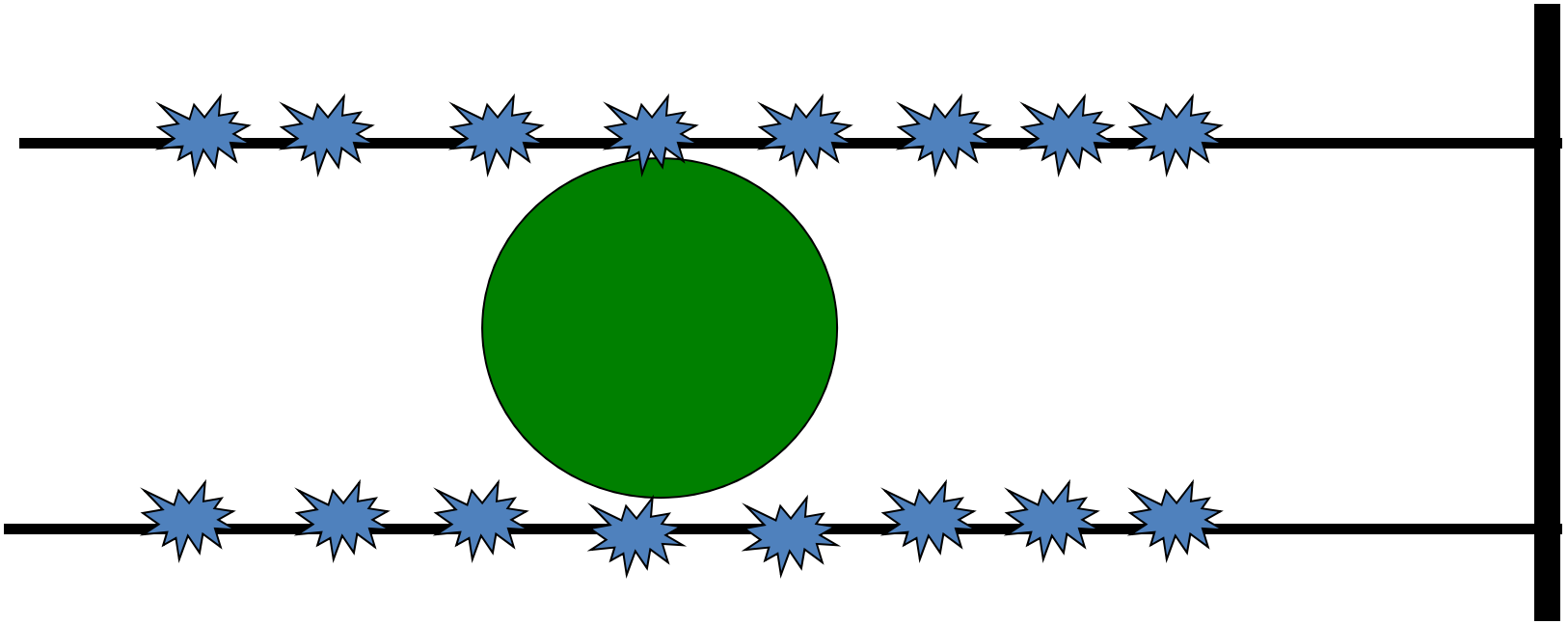
Pecan Irrigation Systems

- Solid Set
  - Expensive
  - Poor water use efficiency
  - Water large area quickly

- Sprinklers often in every other middle
- Pump capacity should be at least 75 gpm/A

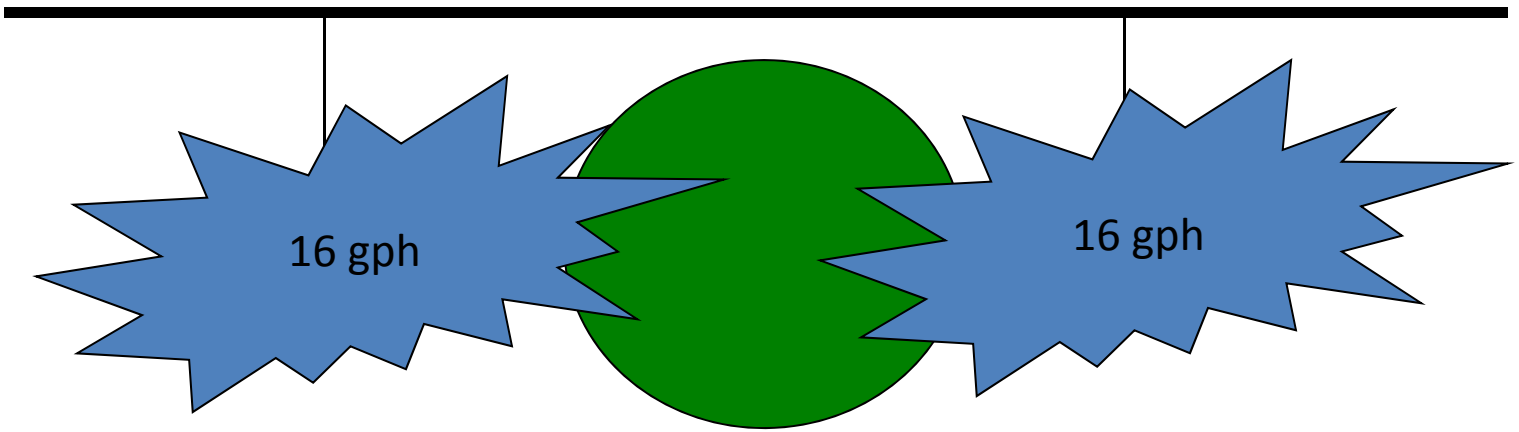
Drip Irrigation

- Lateral lines normally 6-8 ft from tree
- Most emitters used are 2 gph
- 8-16 emitters per tree

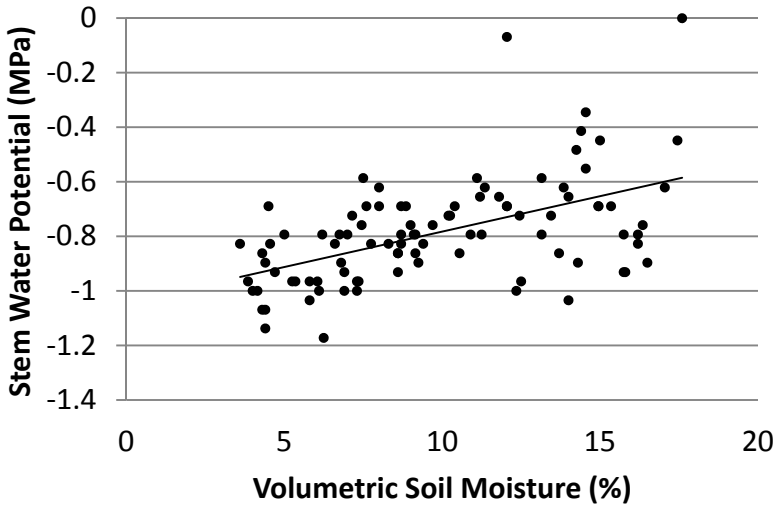


Pecan Irrigation Systems

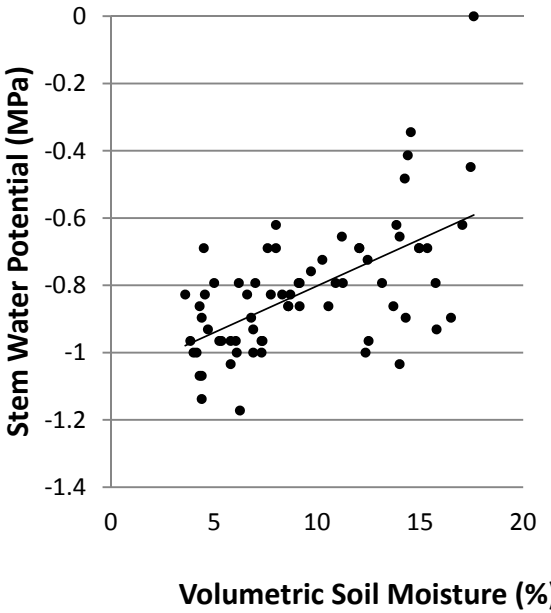
- Microjet
  - Same benefits as drip
  - Larger wetted area
  - Best system for establishment of young trees



Results

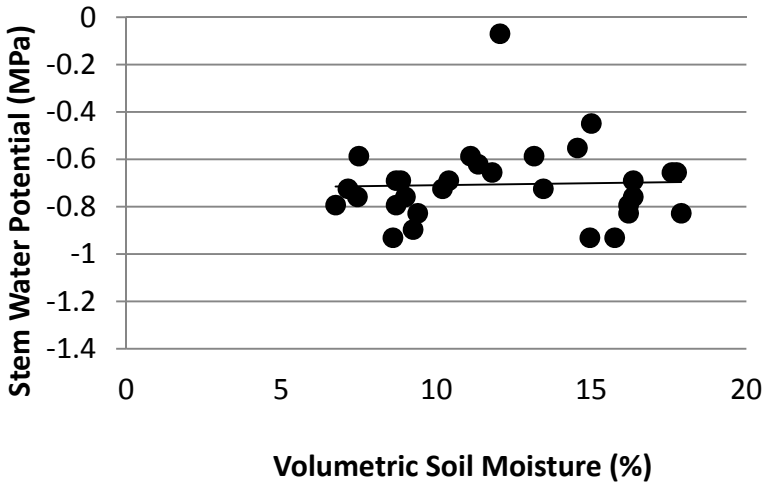


Relationship between stem water potential (ψ) of non-irrigated pecan trees and volumetric soil moisture on Tifton loamy sand (y=0.0259x-1.0421, R^2=0.28).



Relationship between stem water potential (ψ) of non-irrigated pecan trees and volumetric soil moisture on Tifton loamy sand from April-July 2012 (y=0.0277x-1.079, R^2=0.35).

- Water Stress on pecan occurred at about -0.78 MPa using the pressure chamber to measure stem water potential
- Regression analysis suggests that irrigation scheduling for mature pecan trees may be needed when volumetric water content reaches 10-11% on Tifton loamy sand
- Pecan trees may undergo water stress due to crop demand during the kernel filling stage regardless of soil moisture



Relationship between stem water potential (ψ) of non-irrigated pecan trees and volumetric soil moisture on Tifton loamy sand from August-September 2012 (y=0.0017x+0.7263, R^2=0.0014).

Pecan Irrigation Schedule Recommendations for Bearing Orchards

Month	% Full Capacity	Gallons/acre/day
April	17%	**612-680**
May	26%	**936-1040**
June	33%	**1188-1320**
July	40%	**1440-1600**
August	100%	**3600-4000**
September	100%	**3600-4000**

*If you receive 1” or more of rain from bud-break to the onset of kernel-filling, turn the system off for 3 days.

*Throughout the kernel filling period, apply irrigation daily regardless of rain events up to 2”. With a 2” rain during kernel filling, turn the irrigation off for 3 days.

Sandy Soils=Use higher end of rate
Clay Soils=Use lower end of rate

Summary

- IRRIGATION IS A NECESSITY FOR CONSISTENT PECAN PRODUCTION
- Water is key to many important processes involved in the development of a pecan crop
- Well capacity for pecans should be approx. 4000 gal/acre/day
- Irrigation provides the most immediate results and the fastest return on investment of virtually any management practice you can use