Rotation Intensity and Soil Management

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2009 Winter Crop School

Stillwater, OK

Fallow Period

- **Fallow:** The period in a rotational system when no crop is grown in a given area.
  - Fallow periods accumulate water and allow soil nutrients to be released through mineralization.
  - Precipitation storage during fallow is relatively low.
  - Fallow periods reduce soil carbon levels because microbial activity continues (use carbon as energy source) while now carbon is being added to the system.
  - A fallow period does not need to be any longer than necessary to achieve 80 to 100% of stored water capacity.

Water Holding Capacity

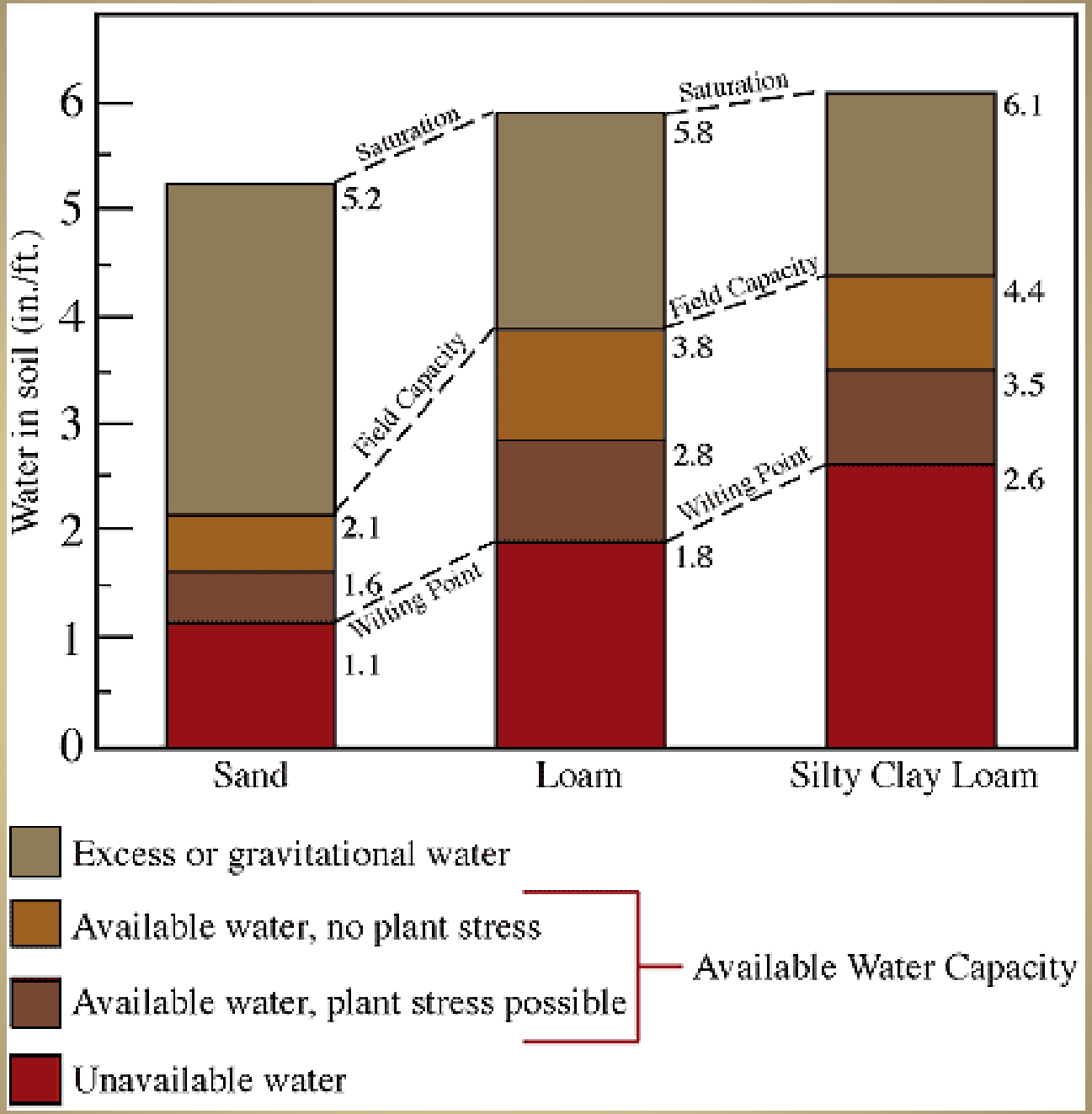
- Water-holding capacity is controlled primarily by soil texture and organic matter.
- Soils with smaller particles (silt and clay) have a larger surface area than those with larger sand particles, and a large surface area allows a soil to hold more water.
- Organic matter percentage also influences water-holding capacity. As the percentage increases, the water-holding capacity increases because of the affinity organic matter has for water.

Water Holding Capacity

Available Water Capacity by Soil Texture

Textural Class	Available Water Capacity (Inches/Foot of Depth)
Coarse sand	0.25–0.75
Fine sand	0.75–1.00
Loamy sand	1.10–1.20
Sandy loam	1.25–1.40
Fine sandy loam	1.50–2.00
Silt loam	2.00–2.50
Silty clay loam	1.80–2.00
Silty clay	1.50–1.70
Clay	1.20–1.50

Plant Available Water

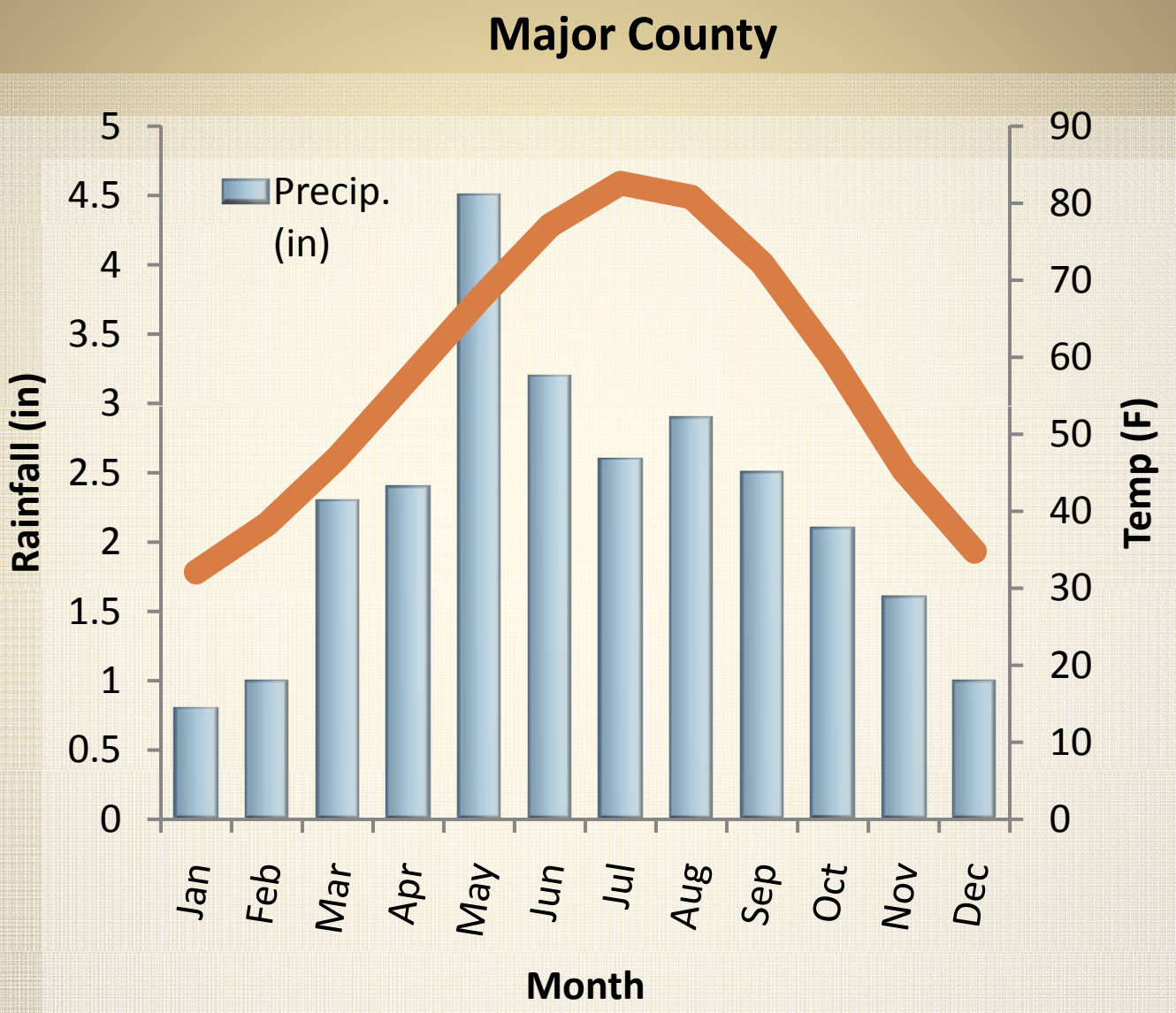


Institute of Agriculture and Natural Resources at the University of Nebraska - Lincoln.

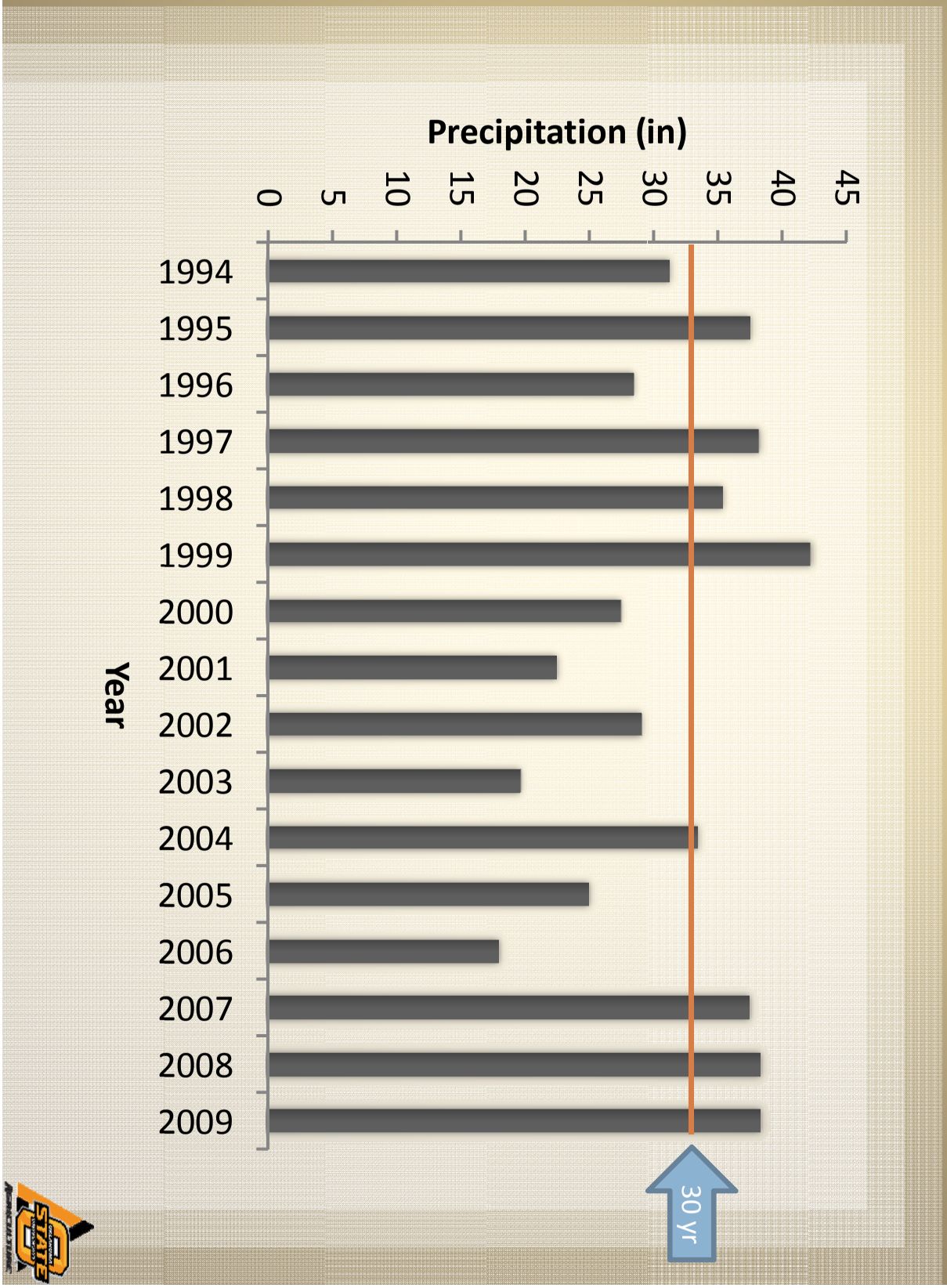
Analyzing Precipitation Trends

- What's the difference between success and failure of summer crops?
  - Planting Date
  - Precipitation timing

Analyzing Precipitation Trends



Lahoma Annual Precipitation 1994-2009



Oklahoma 10-year (1998-2007) average yields, water use efficiencies, and annual transpiration estimates for crops representing more than 1% of total cropland area

	Average yield	Average yield	**WUE[1]**	Transpiration
		lbs acre^{-1}	**bu acre^{-1} inch^{-1}**	inches
Winter wheat	33 bu	1980	**5.3**	6.2
Corn	90 bu	5040	**10.4**	8.7
Sorghum	45 bu	2520	**7.8**	5.8
Soybean	23 bu	1380	**4.0**	5.8
Cotton	0.75 bale	360	**100 (lb)**	3.6
Rye	20 bu	1120	**5.2**	3.6

Intensity

- Number of crops in a given year
  - 3 crops in 2 years
  - 4 crops in 3 years

LCB Rotation

Average Grain Yield - LCB Rotation

TRT Number	Tillage	Rotation	Grain Yield					
			2006-2007 Wheat	2007 Grain Sorghum	2007-2008 Wheat	2008 Corn	2008-2009 Wheat	2009 Corn
			- - - - - - - bu/acre - - - - - - -					
1	CT	Wheat	32		30		22	
2	CT	W-DC-C	30	42		87	19	
3	CT	W-W-DC-C	33		32	winter pea		64
4	NT	Wheat	32		31		23	
5	NT	W-DC-C	31	45		108	20	
6	NT	W-W-DC-C	32		29	winter pea		66

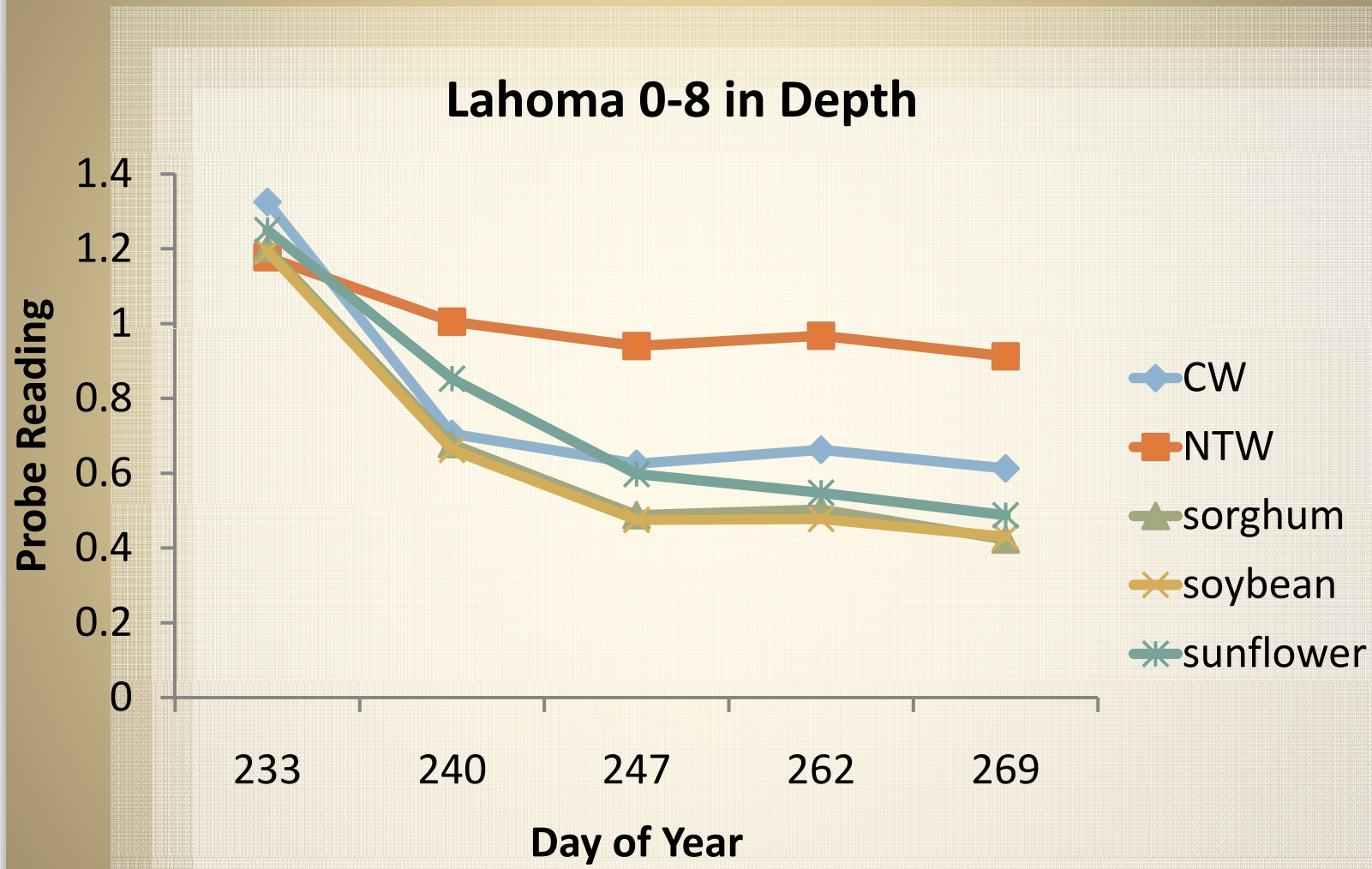
Lahoma Rotation – Water Use

- Crops planted
  - Double crop
    - Soybean – June 25
    - Sunflower – July 1
    - Grain sorghum – June 24

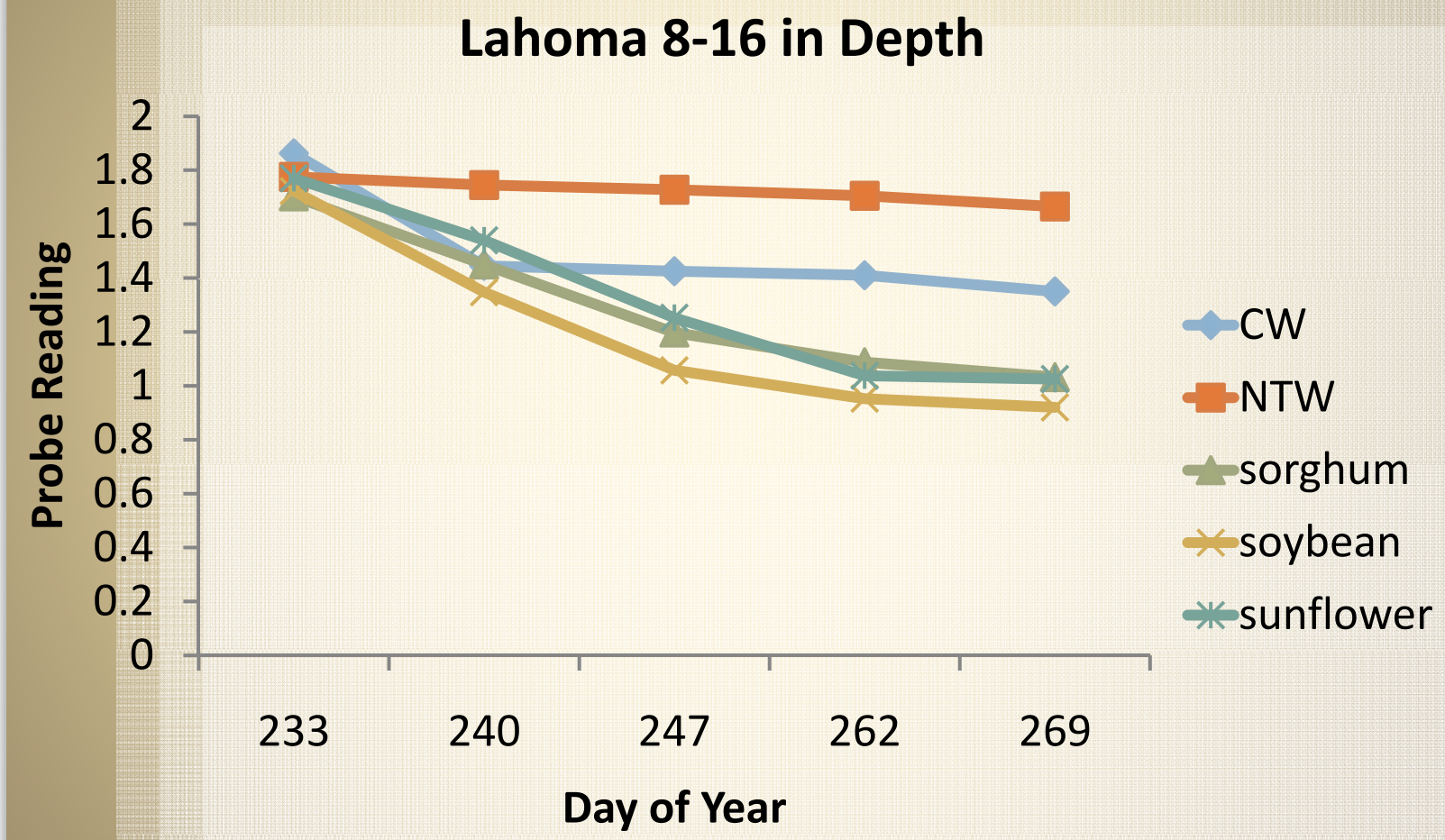
Results - Lahoma

- Timing of maturity affected water use
  - Soybean and sorghum plots driest because trying to set seed.
  - Sunflower was at R5.1 stage at DOY 233, just after last major rain.

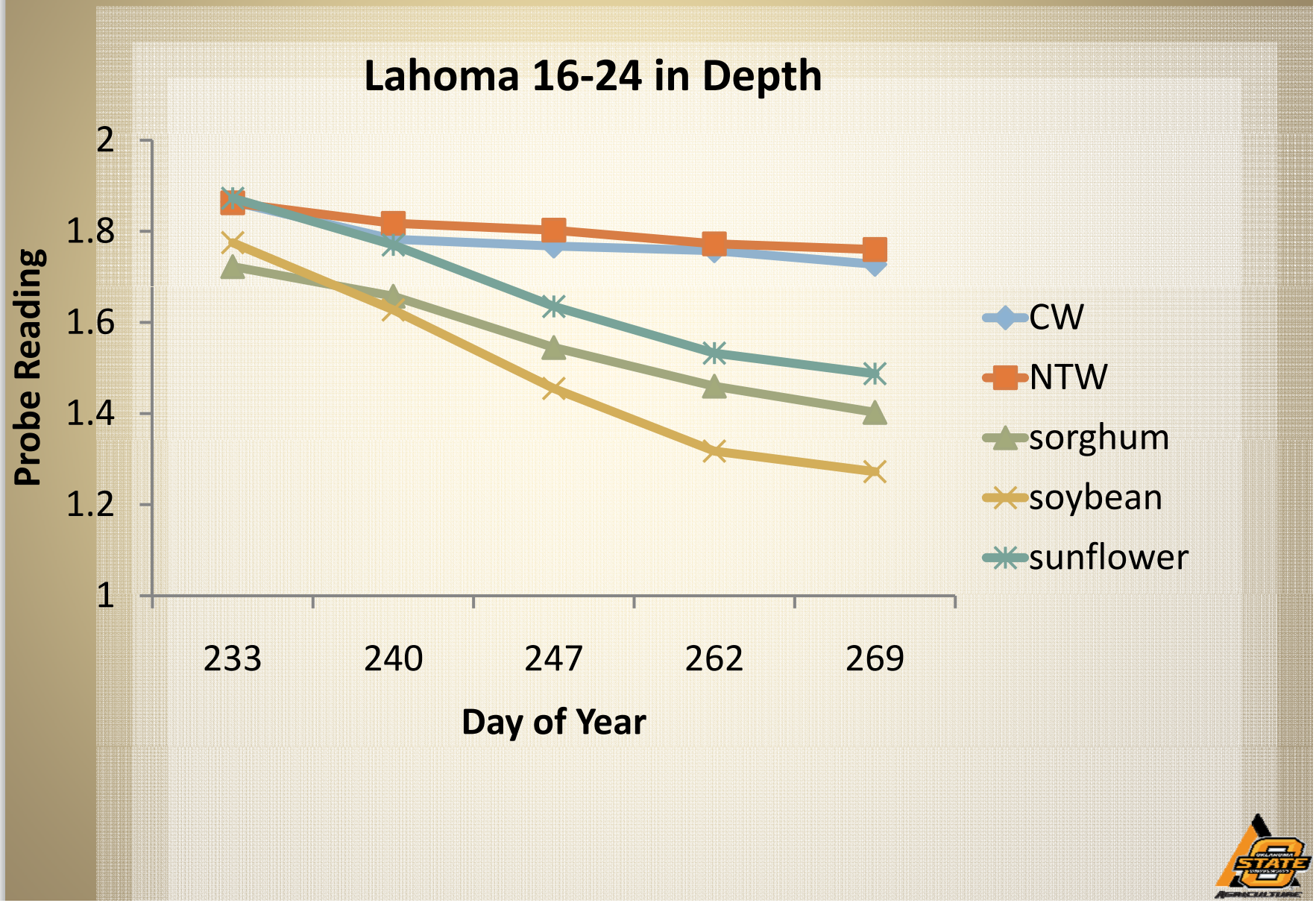
Results


Lahoma 0-8 in Depth
Probe Reading
1.4
1.2
1
0.8
0.6
0.4
0.2
0
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

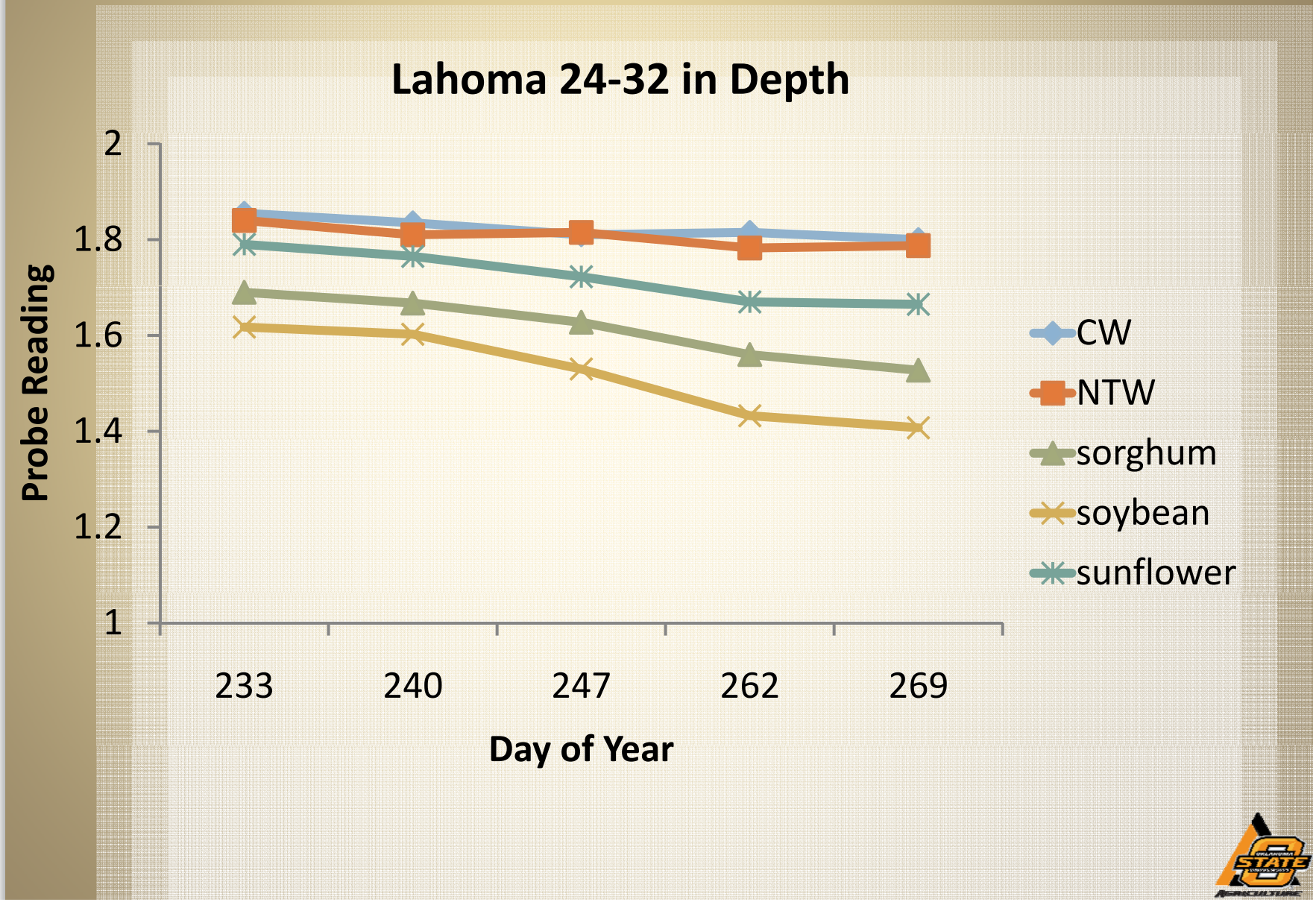
Results


Lahoma 8-16 in Depth
Probe Reading
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

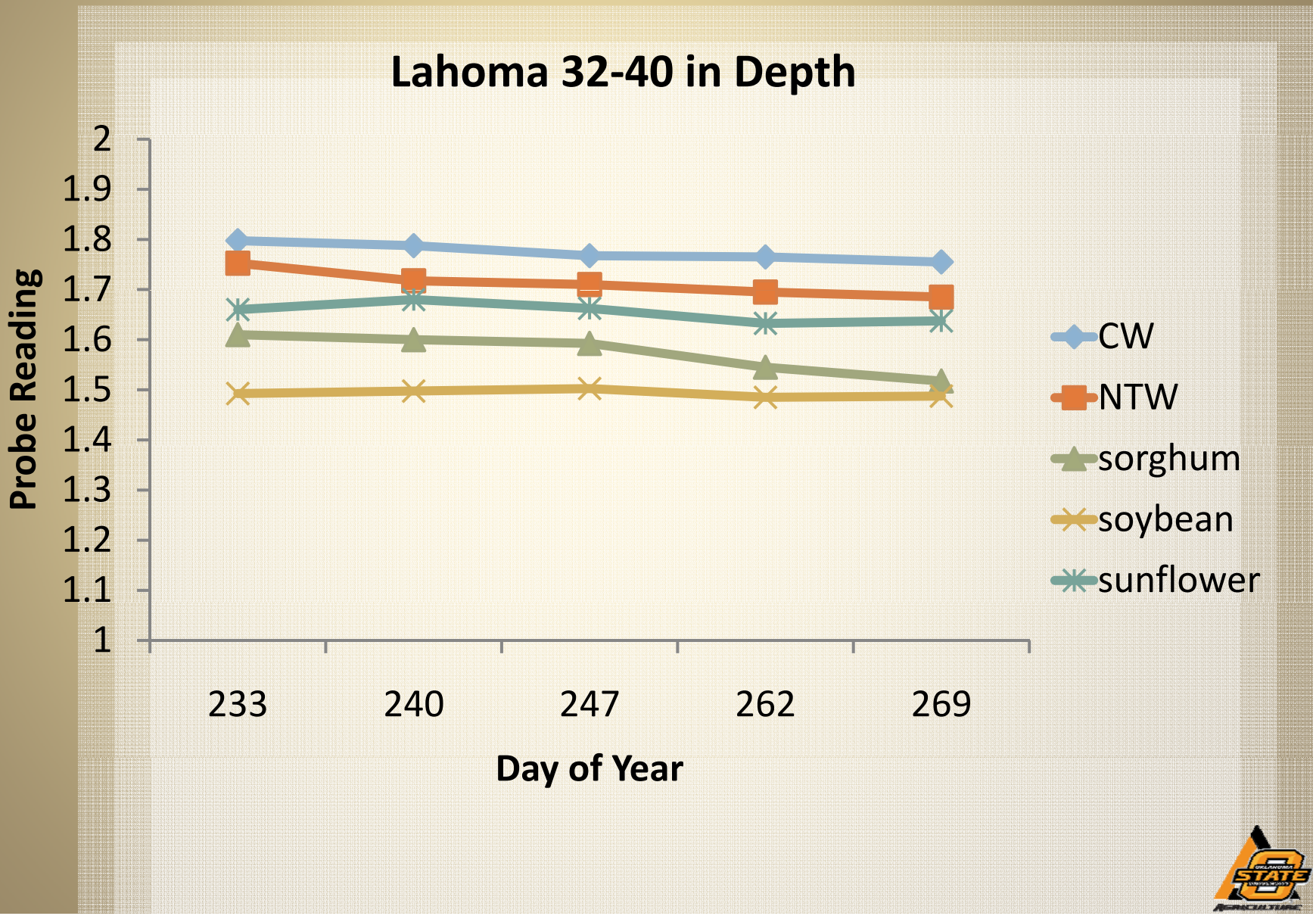
Results


Lahoma 16-24 in Depth
Probe Reading
2
1.8
1.6
1.4
1.2
1
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

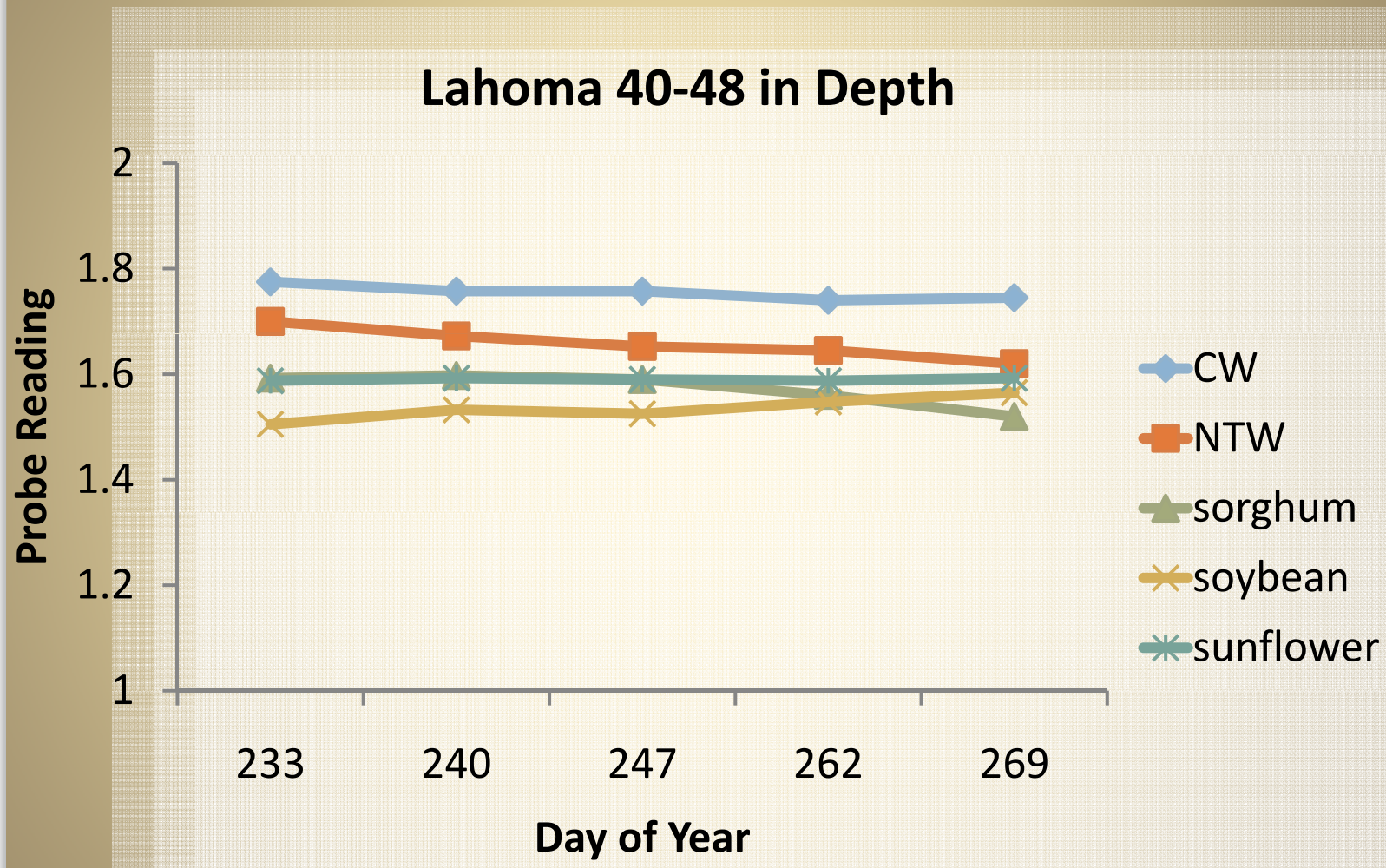
Results


Lahoma 24-32 in Depth
Probe Reading
2
1.8
1.6
1.4
1.2
1
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

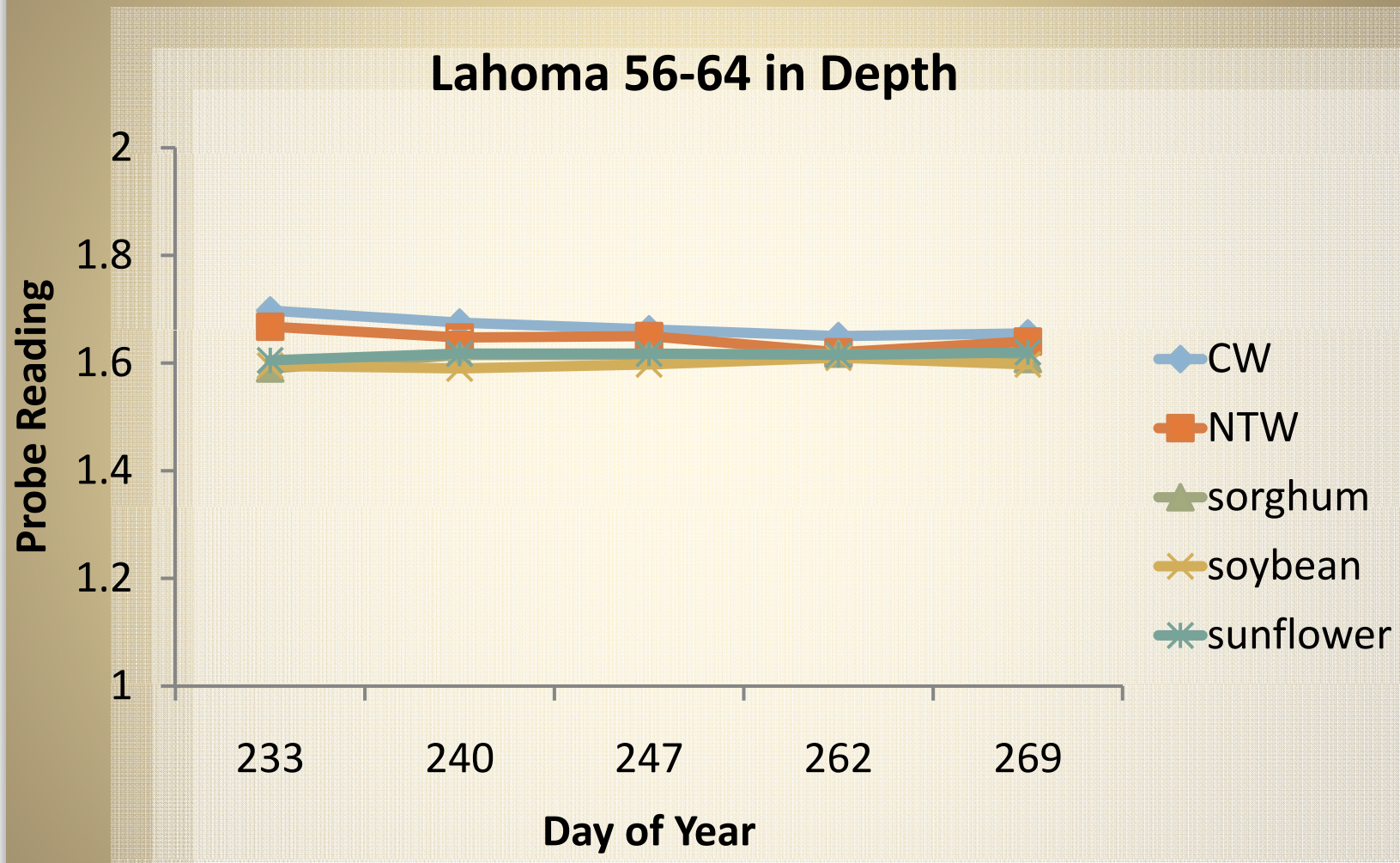
Results


Lahoma 32-40 in Depth
Probe Reading
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

Results


Lahoma 40-48 in Depth
Probe Reading
2
1.8
1.6
1.4
1.2
1
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

Results


Lahoma 56-64 in Depth
Probe Reading
2
1.8
1.6
1.4
1.2
1
233
240
247
262
269
Day of Year
CW
NTW
sorghum
soybean
sunflower

30 in or greater Precipitation

- 3 crops in 2 years
  - Wheat – dc sorghum – soybean
  - Wheat – dc sunflower – grain sorghum
  - Wheat – canola – dc grain sorghum
  - Wheat – dc sesame – soybean
  - Canola – dc grain sorghum - wheat

Wheat – dc sunflower – grain sorghum

Wheat
- 40 bu/ac requires 7.5”

DC Sunflower
- 1500 lb/ac requires 9.5”

Grain Sorghum
- 80 bu/ac requires 9”

7.5 + 9.5 + 9.0 = 26”

25-30 in Precipitation

- 4 crops in 3 years
  - Canola – Wheat – DC sesame – Grain sorghum
  - Canola – Wheat – DC sesame – Cotton
  - Wheat – Wheat – DC Sunflower – Grain sorghum

  - Other possibilities:
    - Safflower
    - Hay grazer
    - Cowpea

Alternative Crops

- Now Crops
  - Sesame
  - Sunflower
- Possibilities
  - Safflower

Sunflower Facts

- Two types produced
- Oilseed type
  - Linoleic
  - Mid-oleic (NuSun) – at least 55% oleic acid
  - High Oleic
- Confection type

Planting

- Advantages
  - Fits well in rotation, especially as a double crop, wide planting window
- Disadvantages
  - Potentially uses water from deep in profile, broadleaf weed control
- Prowl H_2O and Spartan
- Planting Considerations - Seed to soil contact critical
  - Thicker hull requires more moisture to absorb through for germination
- Population ~ 20,000

Hybrid Selection

- Oil content
  - 38- 50%
    - Premium > 40%
- Herbicide tolerance
- Semi-dwarf vs. normal height
  - Yield potential

Safflower

Carthamus tinctorius L.

- Origin: Middle East
- Oil Content: 20-45%
- Premium Oil: Linoleic and Oleic Acid
- Disadvantages: Foliar and Head Rot diseases.
- Advantages: Very drought tolerant due to extensive root system (3 to 10 feet).

Safflower

Carthamus tinctorius L.

- Planting experience so far suggests that safflower establishes relatively easily

Spring Safflower

- Best time to plant?
- Seed germination can handle cold temps down to 40 F
- Initial High Plains seeding is best probably in March, maybe even late Feb.
- Later plantings may suffer from heat and/or Botrytis head rot
- Most current commercial varieties are spring

Results

- Seed oil content was 24-28%

  (Spring Safflower 38-44%)

- Excellent irrigated seed yields

  (1,800 to 2,400 lbs/A)

- Two maturity groups

  (Mid-June & early July)

- No insect pests

- No disease problems

Summary

- **Rotations evolve – not revolve**
- Think long-term
- Maintain flexibility