Management of Invasive Bluestems to Restore Native Grasslands

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Problem

- Kleberg bluestem (*Dichanthium annulatum*) and KR bluestem (*Bothriochloa ischaemum*) planted in Texas has become invasive
- Dense monocultures reduce species diversity and inhibit native plant restoration efforts
- Imazapyr, nicosulfuron + metasulfuron methyl, or summer fire have potential to suppress invasive bluestems for short time periods
- An integrated strategy including cultural practices and herbicides would enhance long-term results

Hypothesis

- The viability of Kleberg and KR bluestem seed decreases over time and there are seasonal changes in the concentration and allocation of nonstructural carbohydrate concentrations within the plant. Knowledge of these two key factors will provide insight about the type and timing of treatments to eradicate or slow the encroachment of Kleberg and KR bluestems.

Objectives

- 1) Determine the longevity of Kleberg and KR bluestem seed in the soil.
- 2) Evaluate the effects of integrated management on invasive bluestem.
- 3) Measure the nonstructural carbohydrate fluctuations within the plant throughout the growing season.
- 3) Develop a Best Practices handbook which shares research results and economic analysis of options for distribution to landowners and managers. Economic and other risks will be included.

Experiment 1

- Part 1: Seed viability
  - Attempt 1
    - CRD with 3 locations at TALR-Beeville
    - 250 seeds in dacron bags burried to 6 inches and incubated for 1 month, 6 months, 1, 2, and 3 years
    - Germination and TZ testing of seed
    - Germination & TZ ~37% initially; 9% at 1 month; could not be measured at 6 months
    - Fungal infection prevented germination and TZ measures at 6 months
  - Attempt 2
    - Repeated with hand harvested seed
    - Germination was 5% and TZ was 4%. At one month, germination could not be determined due to fungal damage of the seed.

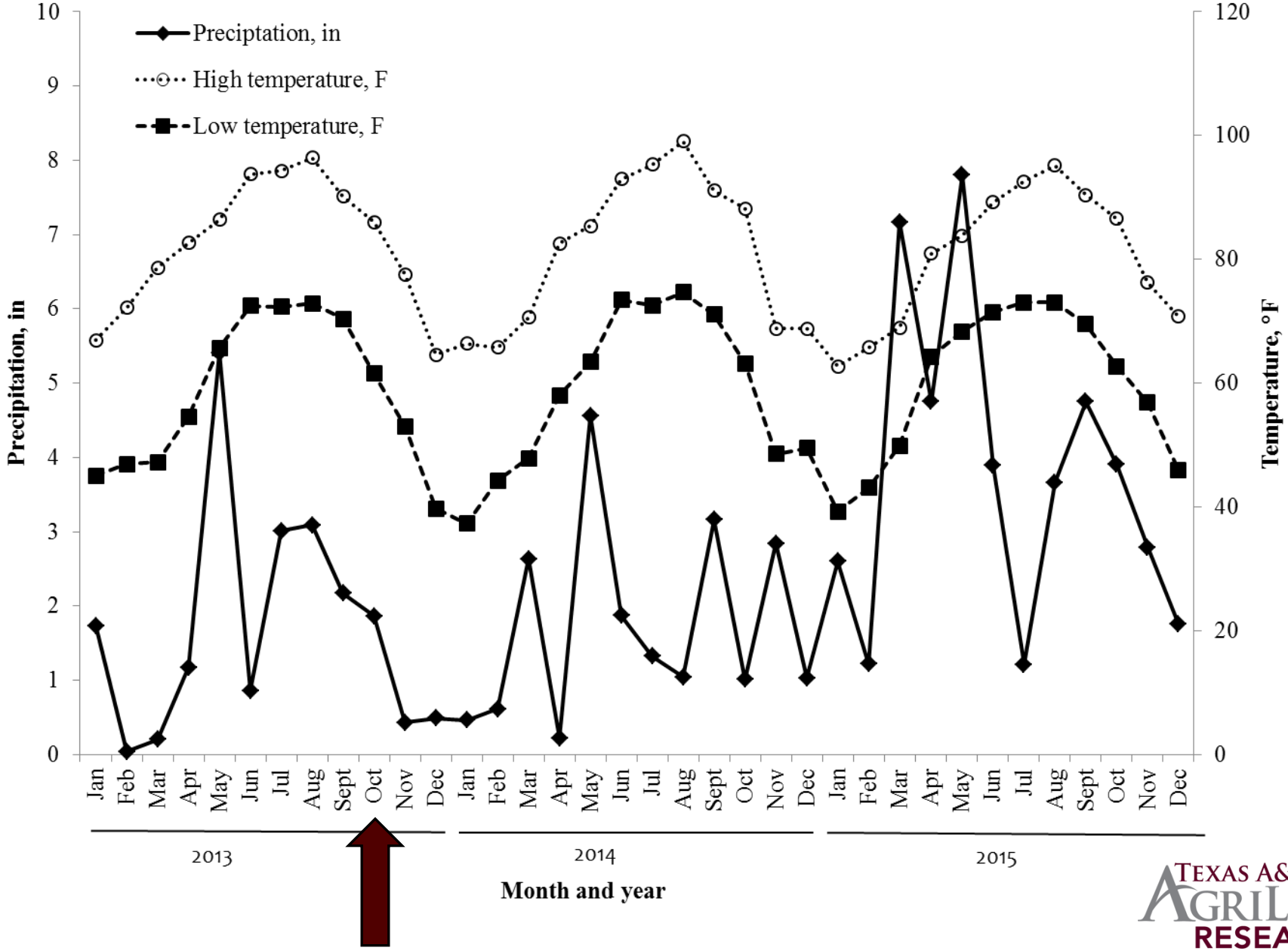
Experiment 1

- Attempt 3
  - New batch of seed collected
  - Different material for bags; sand pit; fungicide
  - Same issue with fungus at 6 months
- Natural phenomenon?
  - Consulted pathologist do not believe so, though this seed is likely susceptible due to the phenotype
  - The costs of replication in sterile environment not possible
- Lack of commercially available seed (this is good news)
- Seed collection on small scale labor intensive

Experiment 3

- Part 2: WSC flow
  - CRBD with 3 blocks and 12 plots (1 per month)
  - 2 samples per plot and 2 years of collections
  - Leaf and stem separated by hand, dried and weighed
  - Roots removed from soil by hand, dried and weighed
  - Outside analyses for CP, ADF, NDF, WSC
  - CP, NDF, WSC over time analyzed with SAS and LSMEANS used to determine differences at each time point
  - CP, NDF, WSC regressed with weather data since last sampling and within last week (high and low temperature and precipitation) using SAS

Weather



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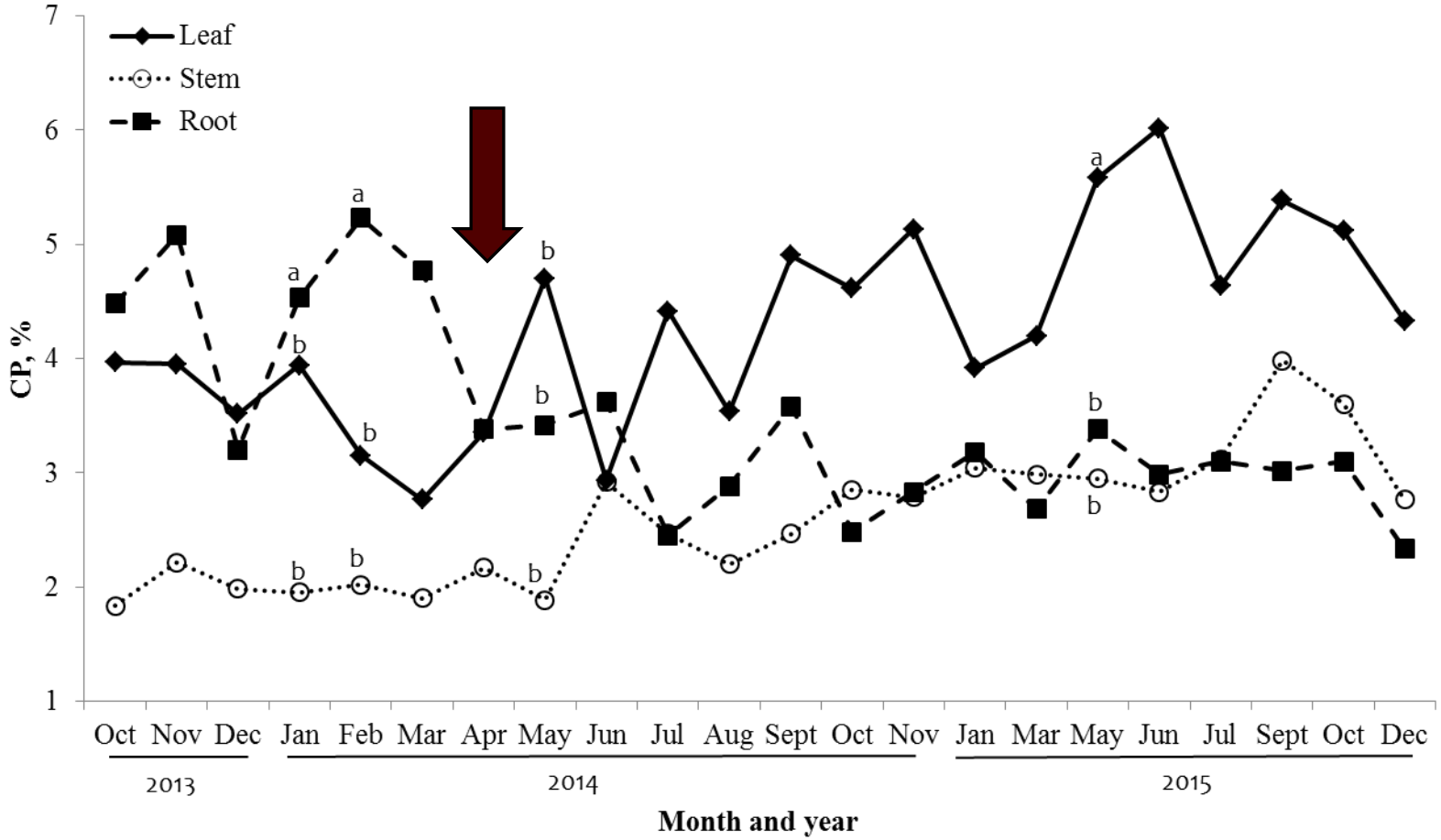
Crude Protein, %



Greatest in leaf, then root, then stem

Part*collection interaction $P < 0.0001$

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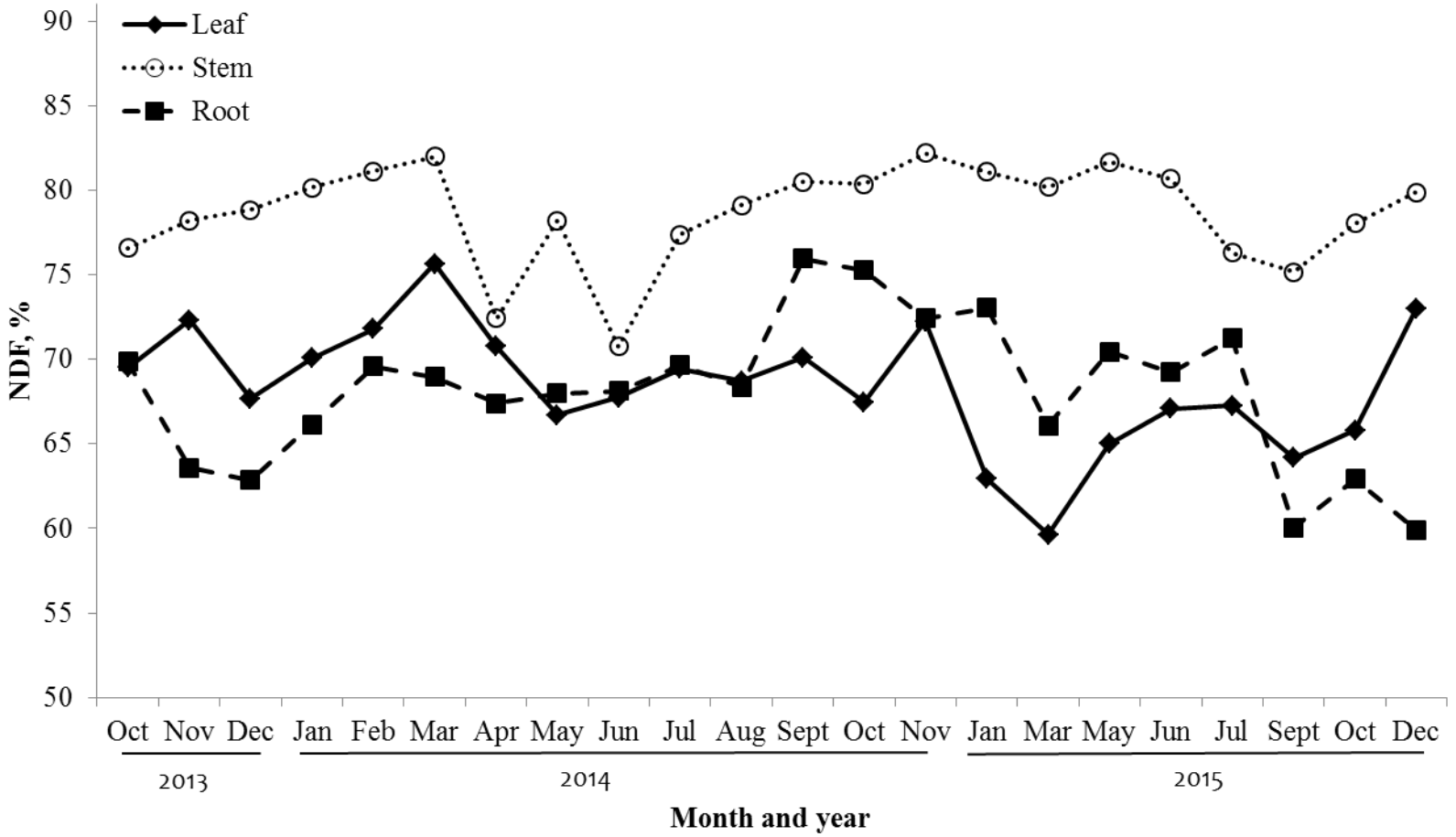
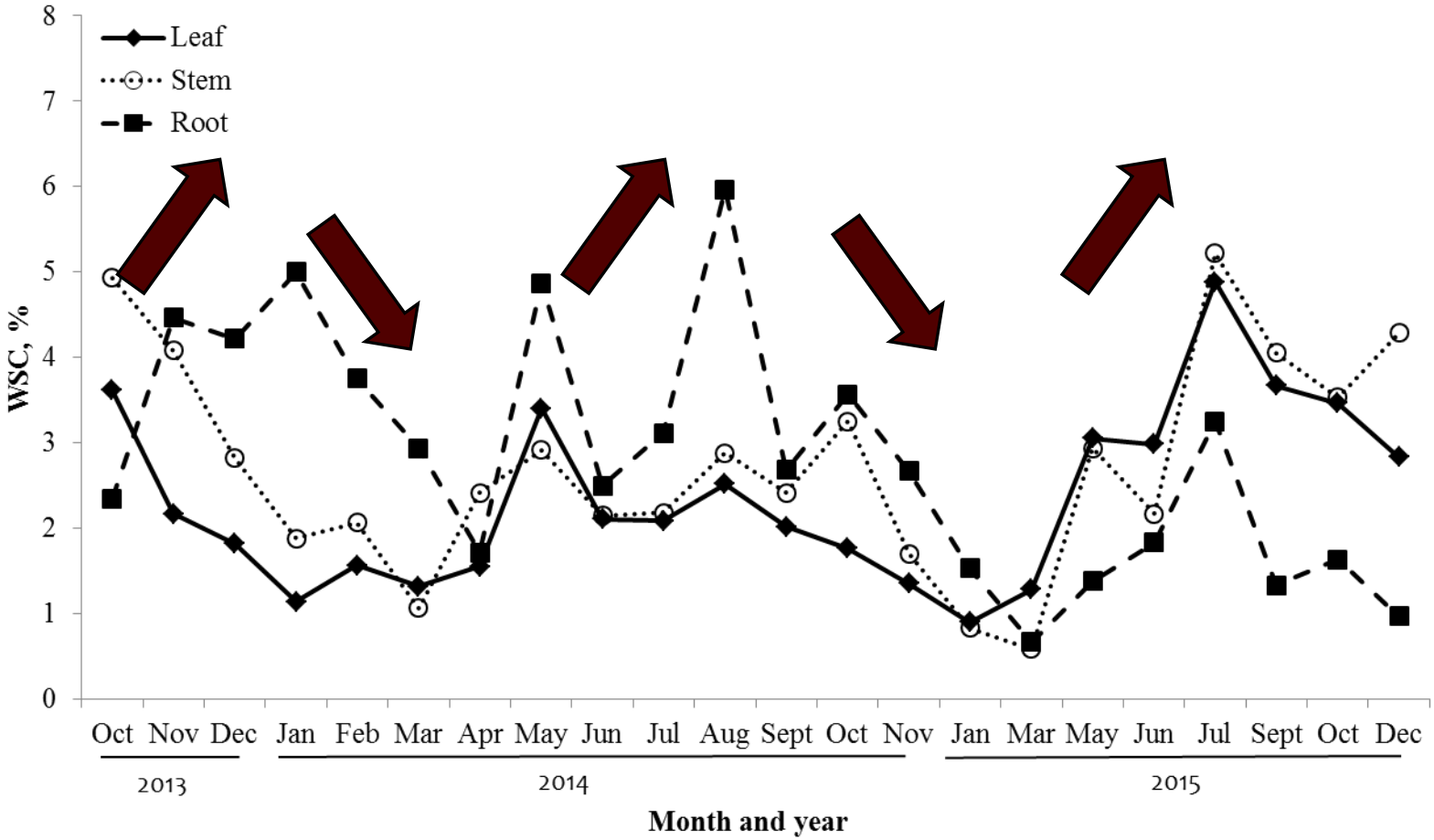
Neutral Detergent Fiber, %



Greater in stem than leaves and roots, which are not different

Part*collection interaction $P < 0.0001$

Water Soluble Carbohydrates, %



Part not different $P = 0.74$

Part*collection interaction $P < 0.0001$

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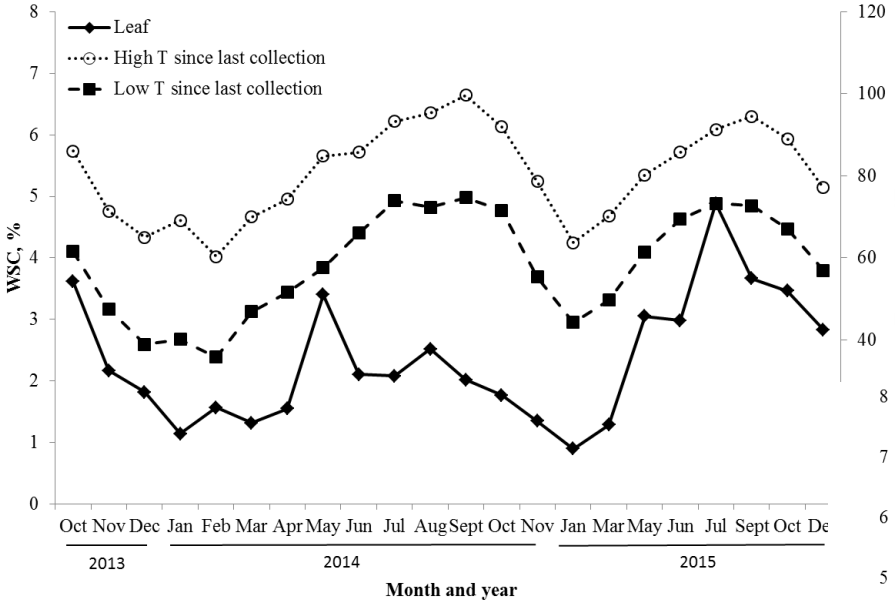
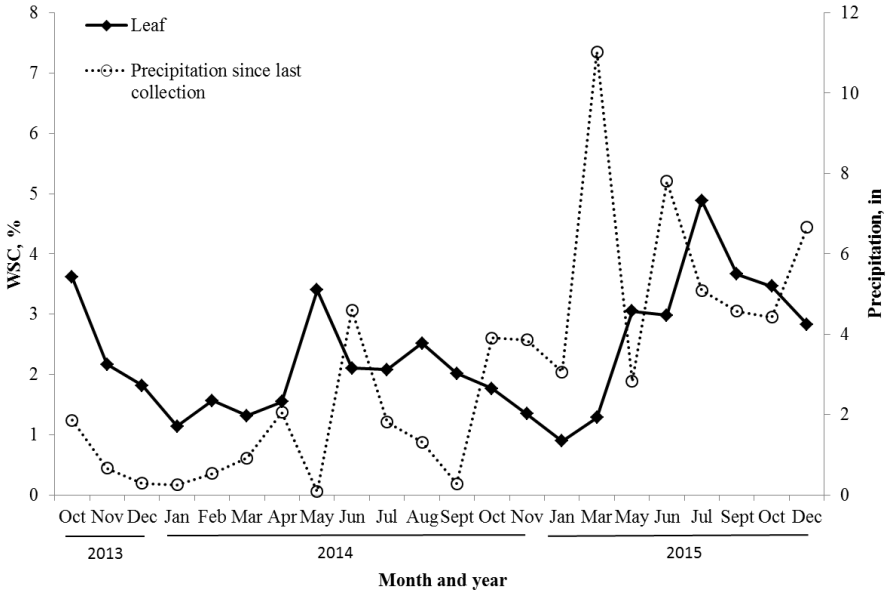
Stepwise Regression

Item	Part	High temperature		Low temperature		Precipitation		Greatest R^2
		Last	1-week	Last	1-week	Last	1-week	
CP	Leaf		Sig	Sig	Sig	Sig		0.25
	Stem		Sig	Sig	Sig	Sig		0.30
	Root		Sig	Sig	Sig	Sig		0.24
NDF	Leaf	Sig	Sig			Sig		0.28
	Stem	Sig		Sig	Sig	Sig	Sig	0.15
	Root	Sig	Sig	Sig	Sig	Sig		0.06
WSC	Leaf[a]	Sig	Sig	Sig	Sig		Sig	0.23
	Stem	Sig	Sig		Sig	Sig	Sig	0.30
	Root	Sig	Sig	Sig	Sig	Sig		0.30

Leaf WSC, % and Weather Since Last Collection





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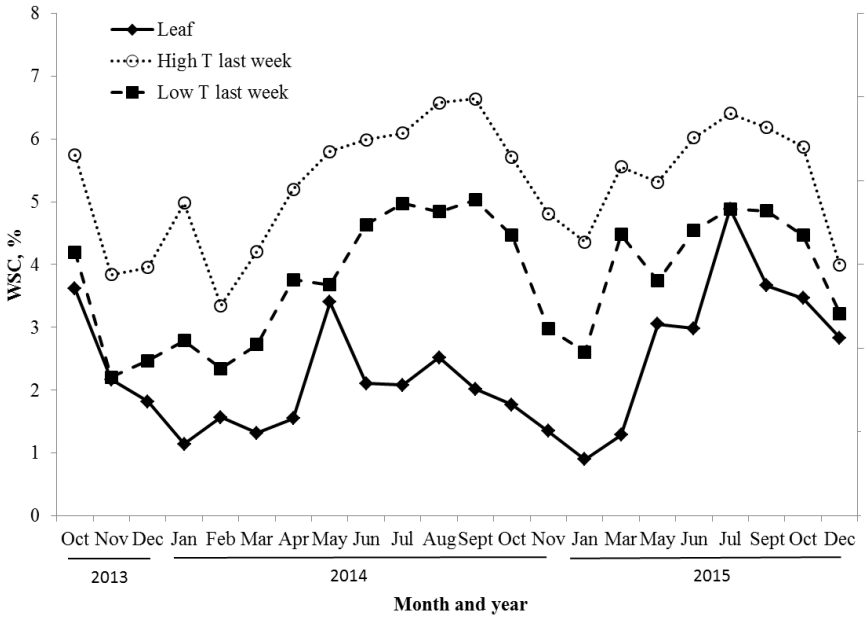
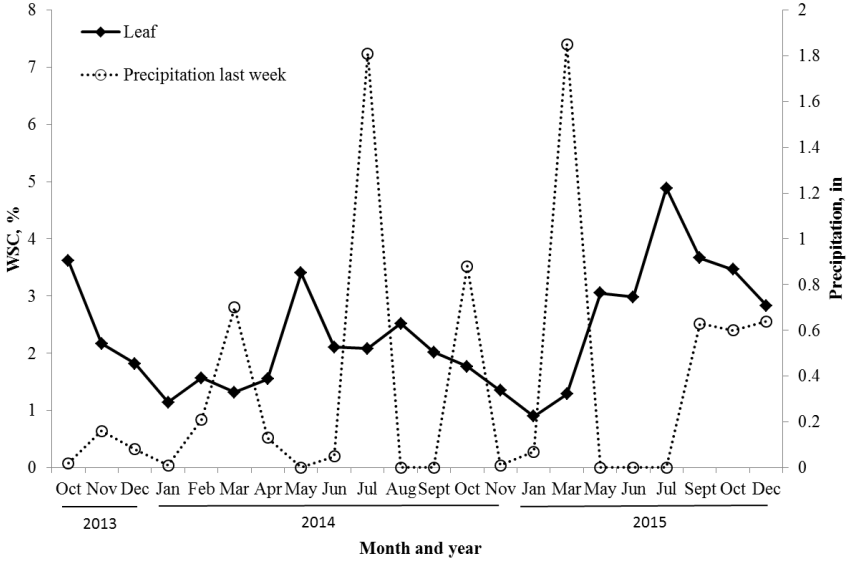
Leaf WSC, % and Weather In Last Week





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Summary: Experiment 2

- Weather (high and low temperature and precipitation) not strongly correlated with CP, NDF, WSC
- May be correlated with magnitude of change due to pattern over time
- Pattern of seasonal flux of WSC when rainfall is adequate
- Target treatment to the flow of WSC to the roots
  - More efficient
  - Nov is interesting timing
  - Modeling
- Nicosulfuron+Metsulfuron application recommendation based on 1 geographic region because of lack of research
- Several studies (Clayton, Grichar, et al.) find temporary suppression with recommended timing, but using weather cues may enhance effectiveness