



# The Impacts of Crop, Soil, Water Management Factors on Corn Silage Yield

2020 Student Research Symposium

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# BACKGROUND



Today's growers face tremendous challenges –  
Unsteady markets, changing climate, input costs,  
natural resource depletion



Resource on the mind of the Intermountain West –  
Water



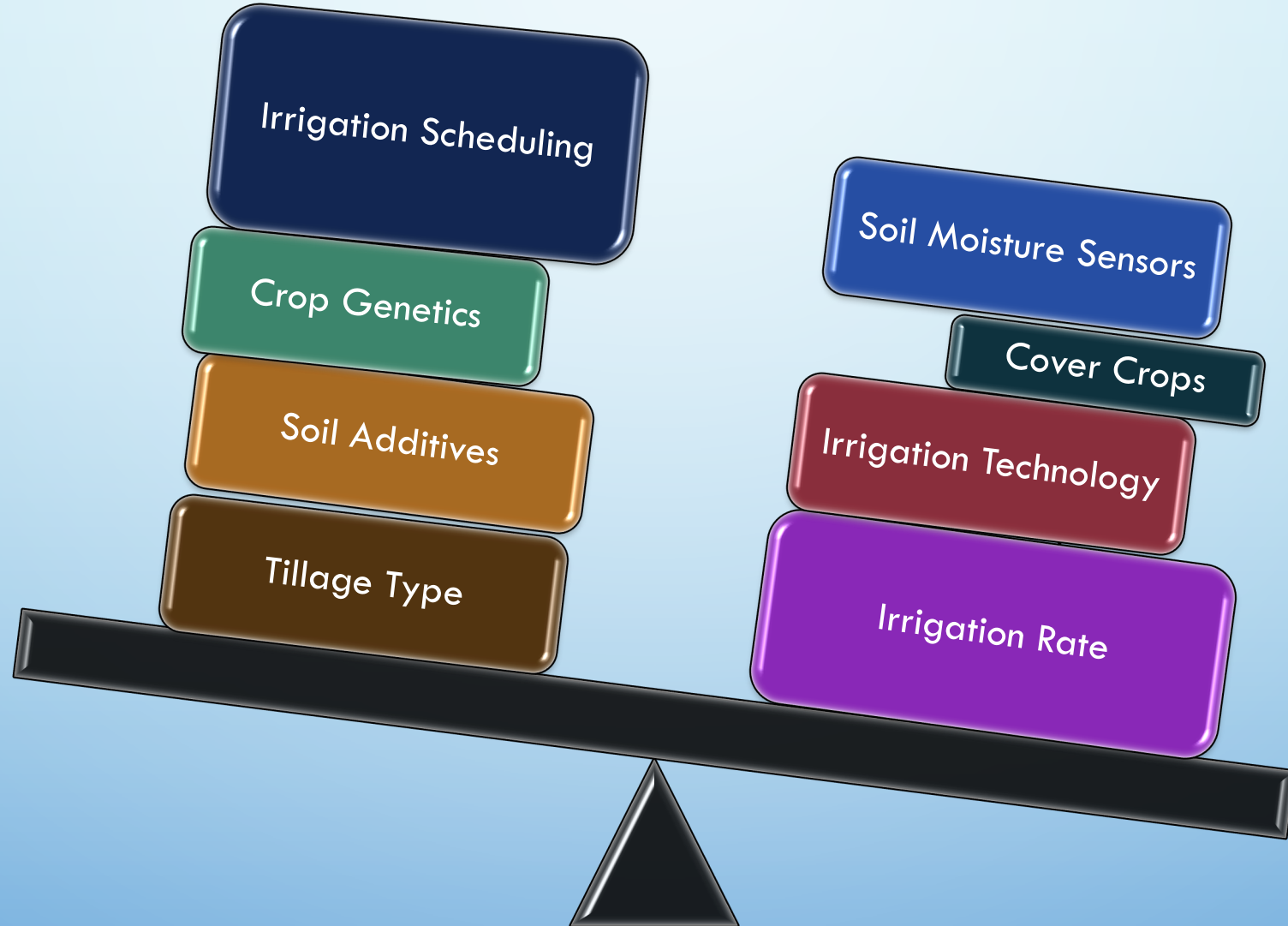
Urban growth, less snowpack, watershed depletion,  
persistent drought strain agricultural water



Water key factor in other aspects of production



# OPTIONS GROWERS ARE OFFERED



# OVERALL PROJECT OBJECTIVES



**Determine which combinations of pivot irrigation systems and rates, crop types and genetics, soil management practices, and soil additives have the greatest ability to optimize:**

- Water use efficiency
- Energy use efficiency
- Nitrogen use efficiency



**Survey Idaho and Utah growers to determine their attitudes and acceptance rates of nitrogen and irrigation 4R practices and identify opportunities and target Extension and outreach efforts**

# WHAT ARE THESE EFFICIENCIES?

## Water Use Efficiency

- Level of biomass or grain yield per unit of water used by the crop (Hatfield et al., 2001)

## Energy Use Efficiency (Farm Energy Efficiency)

- Less irrigation, less energy used: pumping water, moving machinery, etc

## Nitrogen Use Efficiency

- 4R nutrient stewardship concept is based on the application of nutrients of the right source at the right place at the right rate at the right time (Johnston and Bruulsema, 2014)

# WHY A SURVEY?

Acceptance and attitude towards efficiencies

2017 Census: reported 13,159 farms irrigated farmland (71.5%) accounting for 1,097,219 acres

2012 Census: reported 12,296 farms (68.2%) (USDA-NASS, 2019)

2018 NASS Irrigation and Water Management: report 1,181,700 irrigated acres

# HOLES IN RESEARCH & LITERATURE



Studies in the Intermountain West for efficiencies



Studies stacking management options for efficiencies



Studies directly comparing irrigation technologies and rates



Studies directly comparing drought tolerant varieties to non drought tolerant varieties



broad scale agriculture data does not help make decisions  
localized decisions



# FOCUS FOR 2019 SEASON



- Differences in yield and water use efficiency of:
  - Crop genetics
  - Use of a soil additive
  - Irrigation sprinkler technologies
  - Irrigation rates
- Interactions among the various factors

# FACTORS FOR 2019

**Location: Logan, Utah**

## **Crop Genetics**

DROUGHTGARD®  
Non-DROUGHTGARD®

## **Soil Additive**

AQUA-DRIVE®  
No AQUA-DRIVE®

## **Irrigation Sprinkler Technologies**

Mid-elevation Spray Application [MESA]  
3 Low-elevation (Spray Application [LESA],  
Precision Application [LEPA], And Nelson  
Advantage [LENA])  
Mobile Drip Irrigation [MDI]

## **Irrigation Rates**

100%  
75%  
75% Partial  
50%



# DROUGHTGARD GENETICS

- BIOTECH TRAIT CAN INCREASE HYDROEFFICIENCY UNDER DROUGHT STRESS, WHICH CAN RESULT IN INCREASED KERNEL NUMBER AND REDUCED FREQUENCY OF BARREN PLANTS
- GENE FROM SOIL BACTERIA - BACILLUS SUBTILIS



***DroughtGard***<sup>®</sup>  
HYBRIDS

# AQUA-DRIVE

- AQUA-DRIVE — The #1 soil wetting agent on the market!
- Non-ionic surfactant additive designed to improve soil wetting and penetration of treated irrigation water.
- Reduces the surface tension of water to as much as 60%, allowing water to flow in a more effective pattern through the soil profile, preventing deep movement of herbicides
- Rate of 1.5 to 3 pints per acre

aqua\_drive\_2.5g\_F\_012611.pdf 1 1/27/11 10:48 AM

**Additive to Improve Wetting and Penetration Characteristics of Irrigation Water**

## Aqua-Drive™

**Additivo Para Mejorar las Características de Mojar y Penetrar el Agua de Irrigación**

CONTAINS NON-PLANT FOOD INGREDIENTS		CONTIENE INGREDIENTES NO-PLANTA DE ALIMENTOS	
Copolymers of polyethylene & polypropylene glycols.....	25.0%	Copolímeros de polietileno y glicoles de polipropileno.....	25.0%
Inert ingredients.....	75.0%	Ingredientes inertes.....	75.0%
Total.....	100.0%	Total.....	100.0%

Exempt from a tolerance as specified in 40 CFR 180.

**CAUTION**  
KEEP OUT OF REACH OF CHILDREN

**PRECAUTIONARY STATEMENTS**  
CAUTION: May cause eye irritation. Do not get in eyes. Avoid breathing vapors or mists. Avoid using product in a manner as to directly, or through drift, expose workers or other persons. Always consult the material safety data sheet for specific instructions. Applicators and other handlers must wear goggles or a facial splash shield; chemical resistant gloves, such as nitrile rubber >14 mils or neoprene rubber >14 mils, coveralls or long sleeved shirt and long pants, shoes plus socks.

**FIRST AID MEASURE IN CASE OF CONTACT**  
Eye contact: DO NOT RUB EYES. Immediately flush eyes with large amounts of water for 15 minutes, lifting the lower and upper lids. Seek medical attention if necessary.  
Skin contact: Remove contaminated clothing and immediately wash affected area with large amounts of water for at least 5 minutes. If irritation or redness persists, seek medical attention as needed.  
If swallowed: Give large amounts of water to drink. Seek medical attention if necessary. Induce vomiting only upon advice from a physician.  
Inhalation: Move individual to fresh air and check to assure adequate respiration. Seek medical attention if necessary.

Information regarding the contents and levels of metals in this product is available on the internet at: <http://www.aapfco.org/metals.htm>.

**NET CONTENTS (Gallons/Galones, Liters/Litros):**  
☐ 2 x 2.5 Gal (18.927 L)    ☐ 2.5 Gal (9.46 L)  
☐ 30 Gal (113.52 L)    ☐ 55 Gal (208.12 L)  
☐ 265 Gal (1,003.13 L)

**PRECAUCIÓN**  
MANTENGA FUERA DEL ALCANCE DE LOS NIÑOS

**DECLARACIONES PREVENTIVAS**  
PRECAUCIÓN: Puede causar irritación de los ojos. No permita que le caiga en los ojos. Evite respirar vapores y rocíos. Evite usar el producto en una forma que directa o indirectamente exponga a los trabajadores o a otras personas. Siempre consulte la hoja de seguridad de materiales para instrucciones específicas. Los aplicadores y otras personas que trabajen con el producto tienen que usar anteojos de seguridad o un protector facial contra salpicaduras; guantes resistentes a químicos, tales como hule de nitrilo >14 o de >14 mils de neopreno, manguitos o camisas de manga larga o pantalones, zapatos y medias.

**MEDIDAS DE PRIMEROS AUXILIOS EN CASO DE CONTACTO**  
Contacto con los ojos: NO SE FROTE LOS OJOS. Inmediatamente lave los ojos con abundante agua durante 15 minutos, levantando cada párpado. Busque atención médica si es necesario.  
Contacto con la piel: Quite la ropa contaminada y lave el área afectada inmediatamente con grandes cantidades de agua por lo menos durante 5 minutos. Si la irritación o el enrojecimiento persisten, busque atención médica según sea necesario.  
Si se ingiere: Dé a tomar grandes cantidades de agua. Busque atención médica si es necesario. Provoque el vómito sólo si un médico lo recomienda.  
Inhalación: Mueva a la persona para que tome aire fresco para asegurar que respire adecuadamente. Buscar atención médica si es necesario.

La información referente al contenido y niveles de metales en este producto está disponible en internet en: <http://www.aapfco.org/metals.htm>.

**AD02F**    Diamond K 1720 South Red Hills Dr. Richfield, UT 84701    1/26/11

# IRRIGATION TECHNOLOGIES



**LEPA**



**MDI**



**LESA**



**MESA**



**LENA**



LEPA				MDI				LESA				MESA				LENA			
100	50	75	50P	75	50	100	50P	50	50P	75	100	50P	100	50	75	75	100	50P	50



# FIELD SITES – LOGAN CROP GENETICS & SOIL MANAGEMENT

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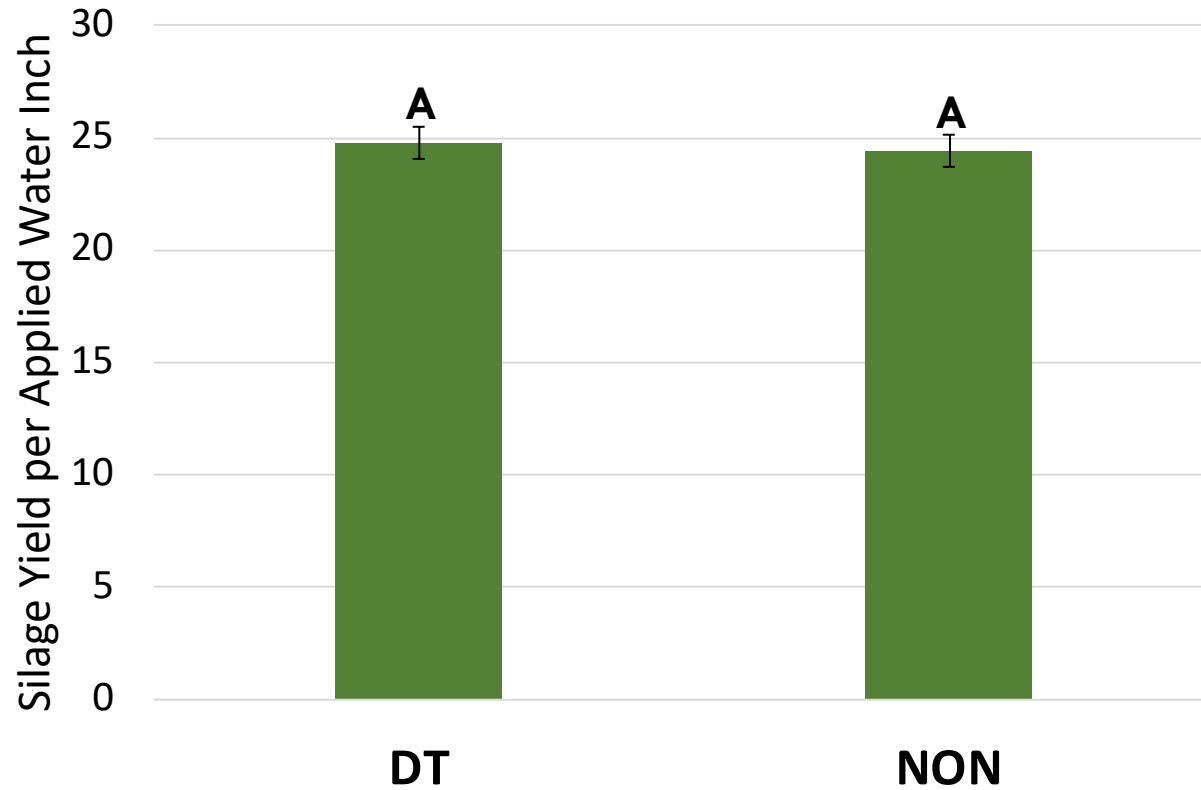
2019 RESULTS



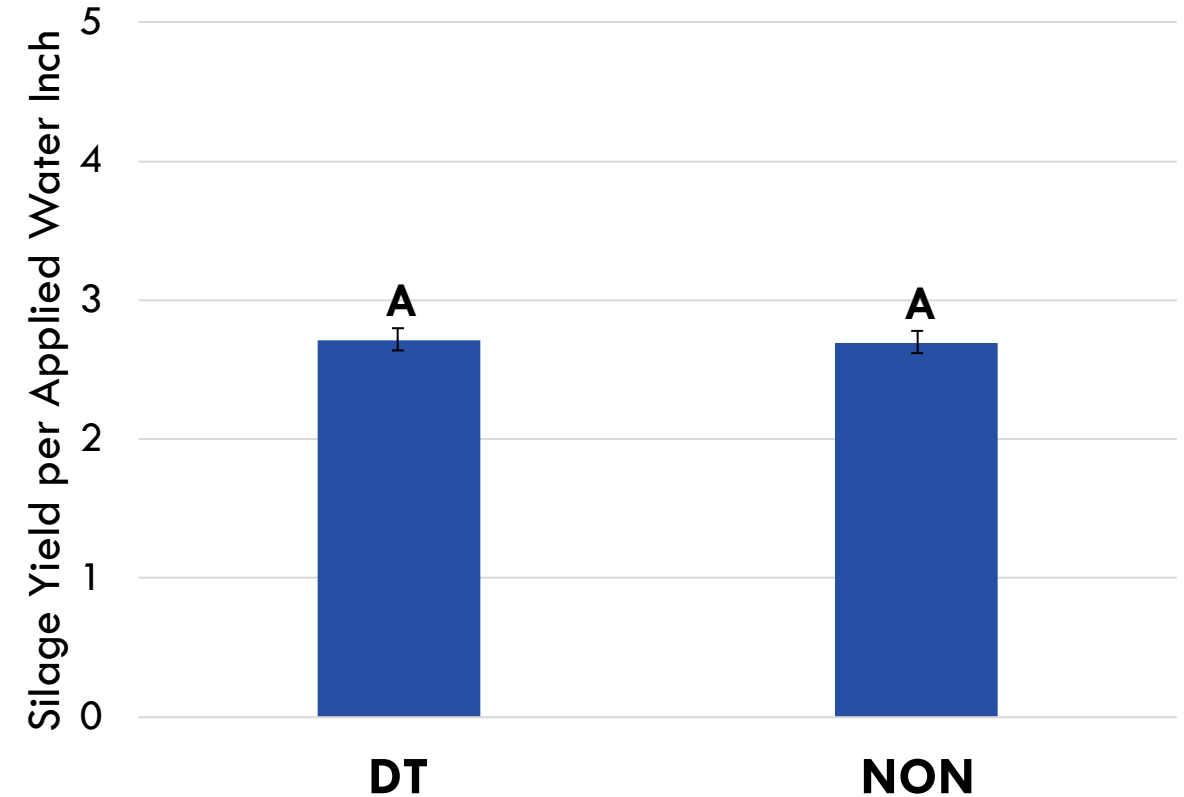
# CROP GENETIC EFFECTS



## Yield - Crop Genetics



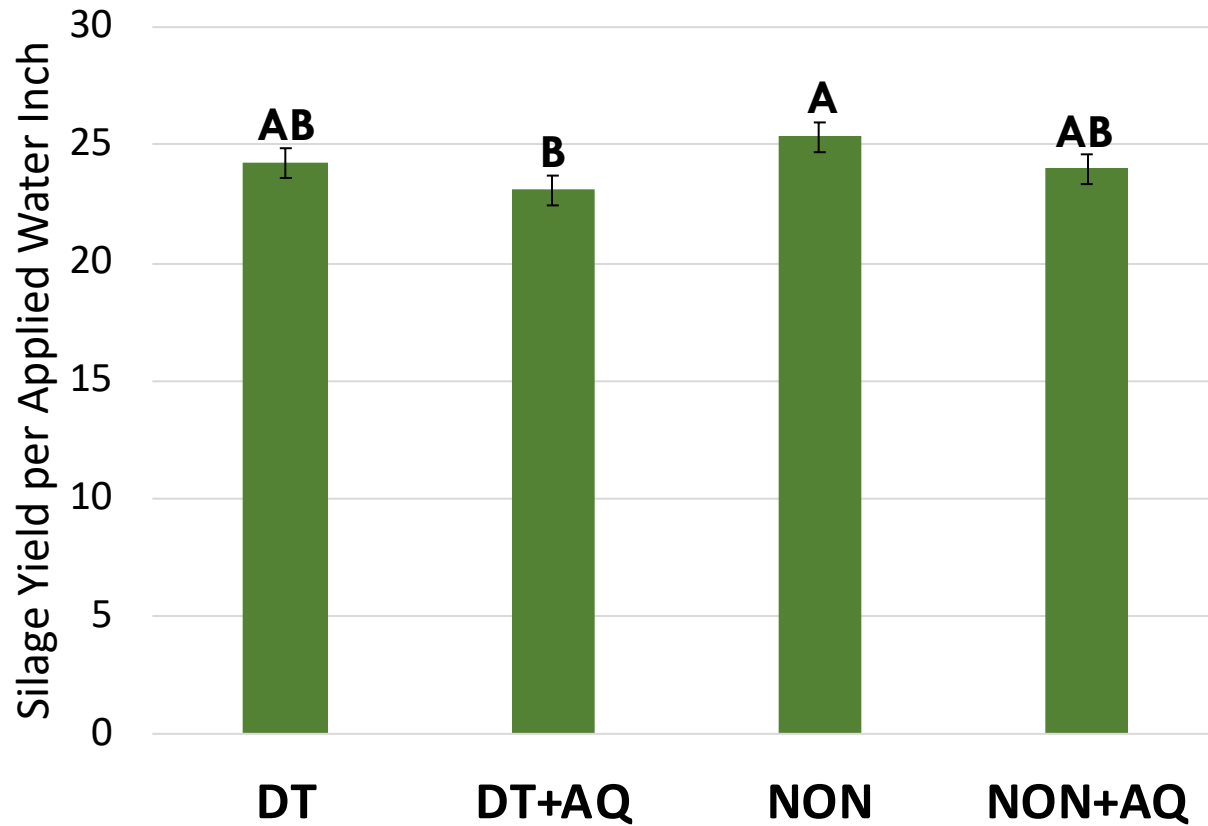
## Irrigation Productivity - Crop Genetics



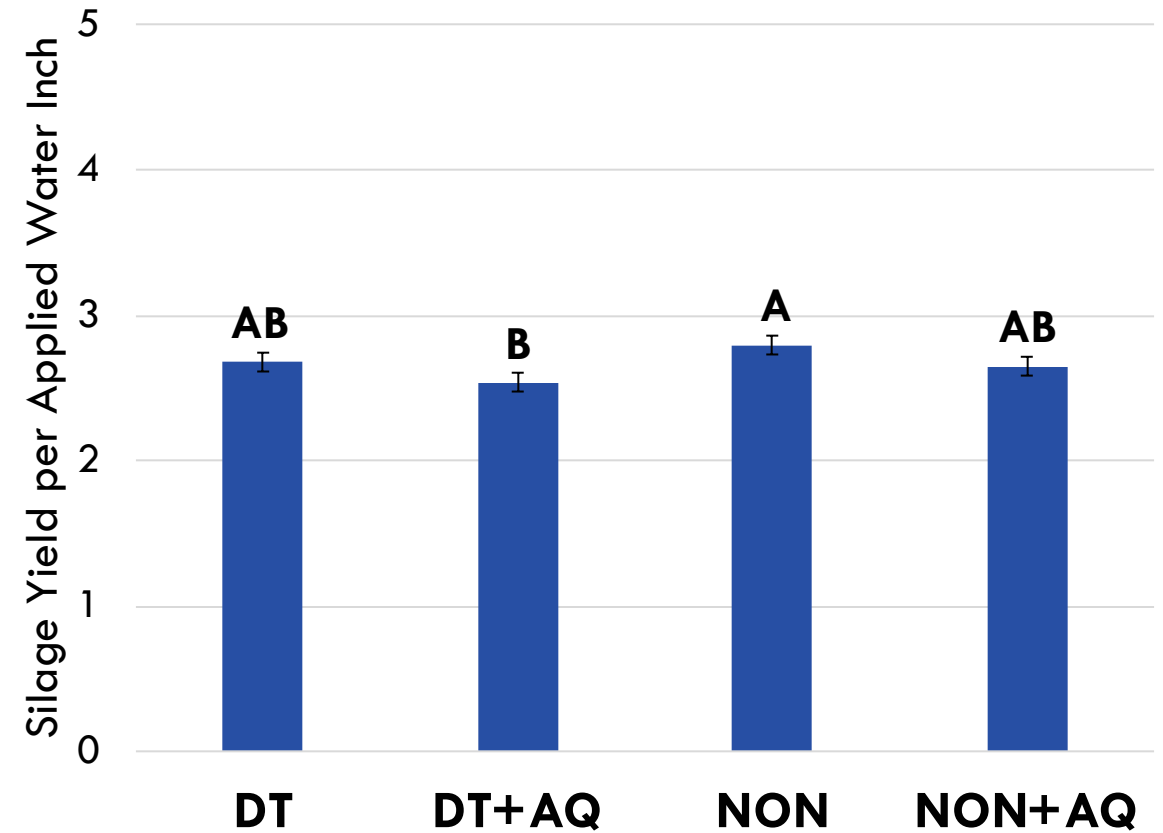
# SOIL ADDITIVE EFFECTS



## Yield - Soil Additive



## Irrigation Productivity - Soil Additive

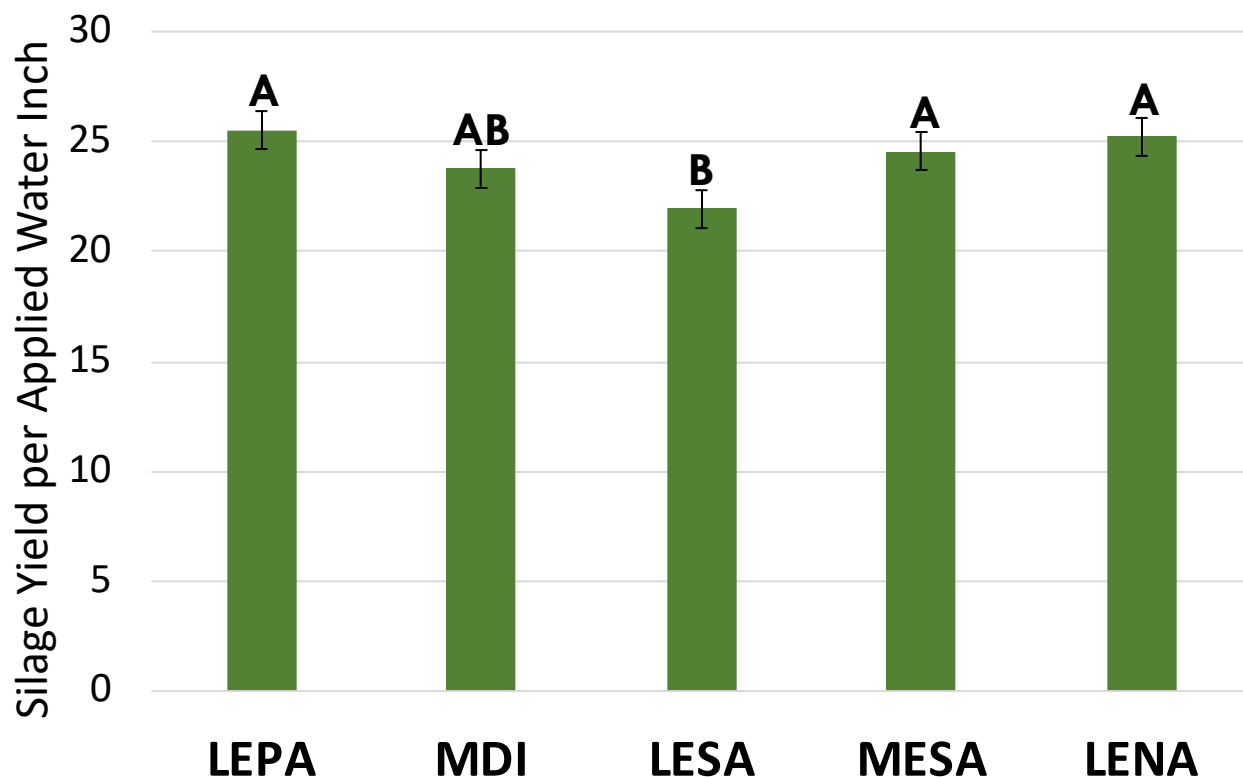




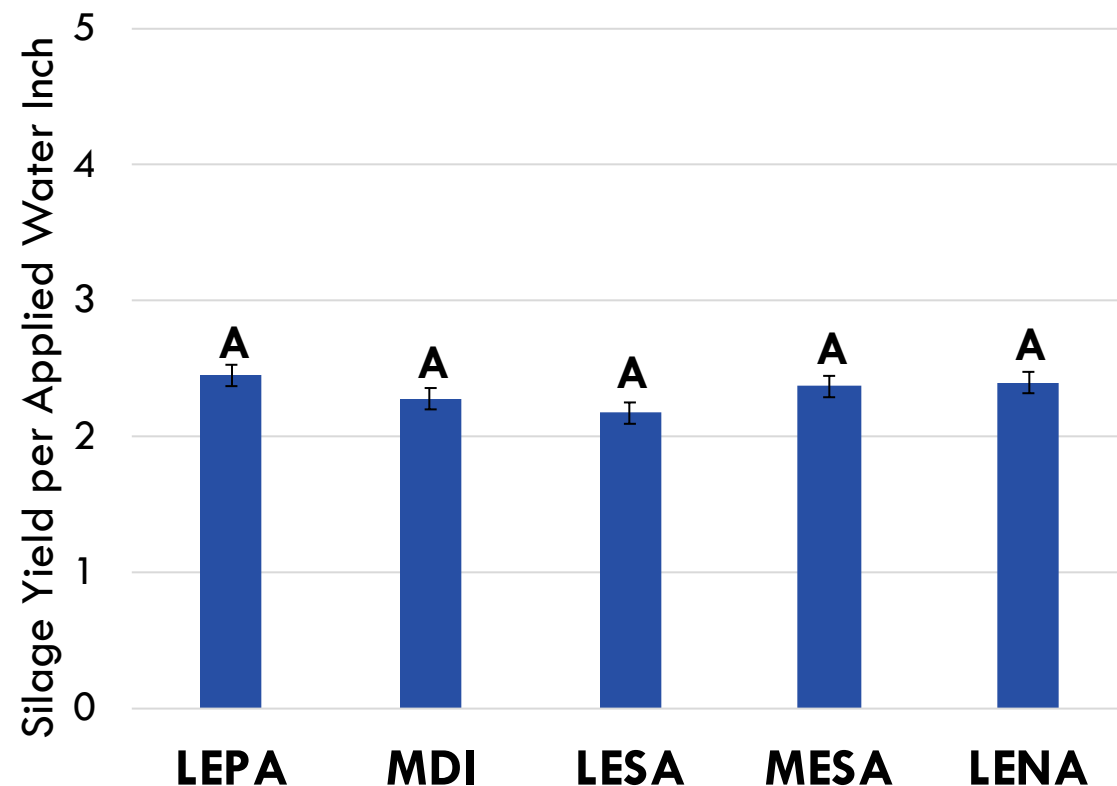
# IRRIGATION TECHNOLOGY EFFECTS



## Yield - Irrigation Technologies



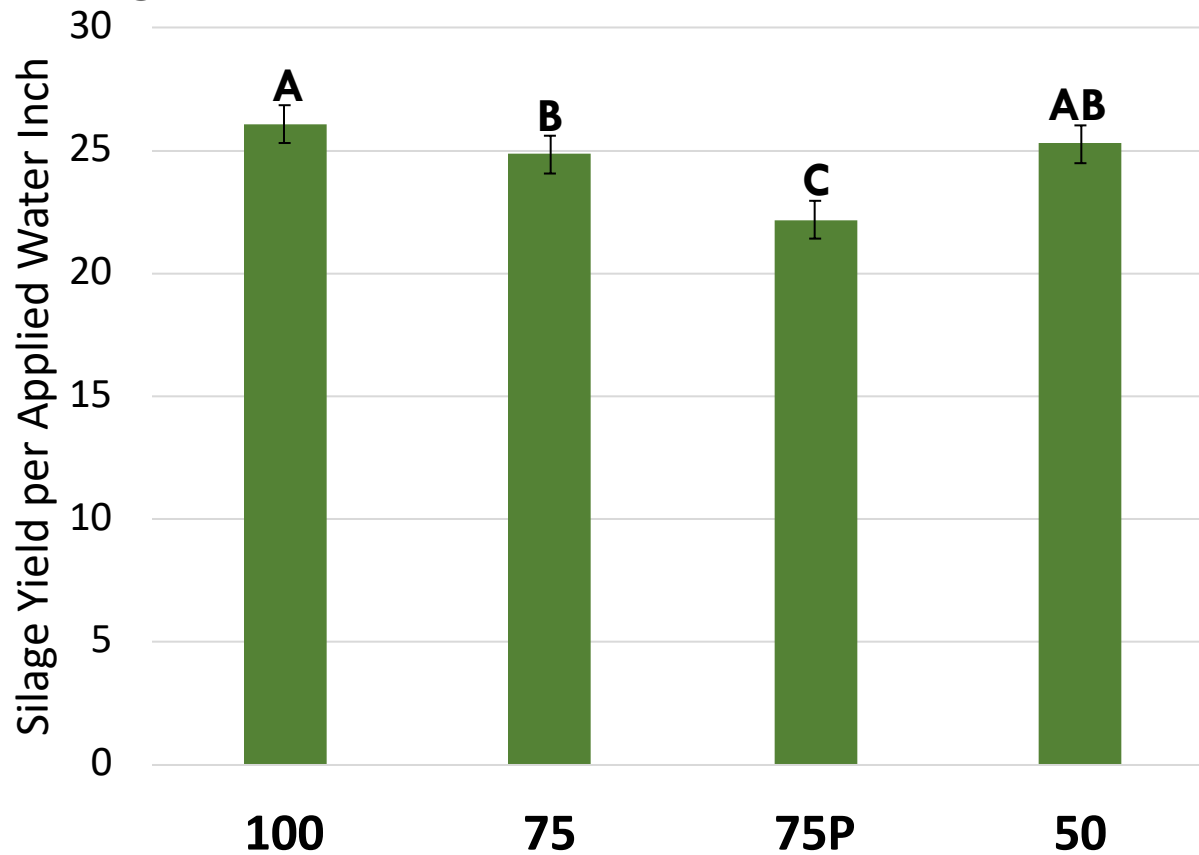
## Irrigation Productivity – Irr. Technology



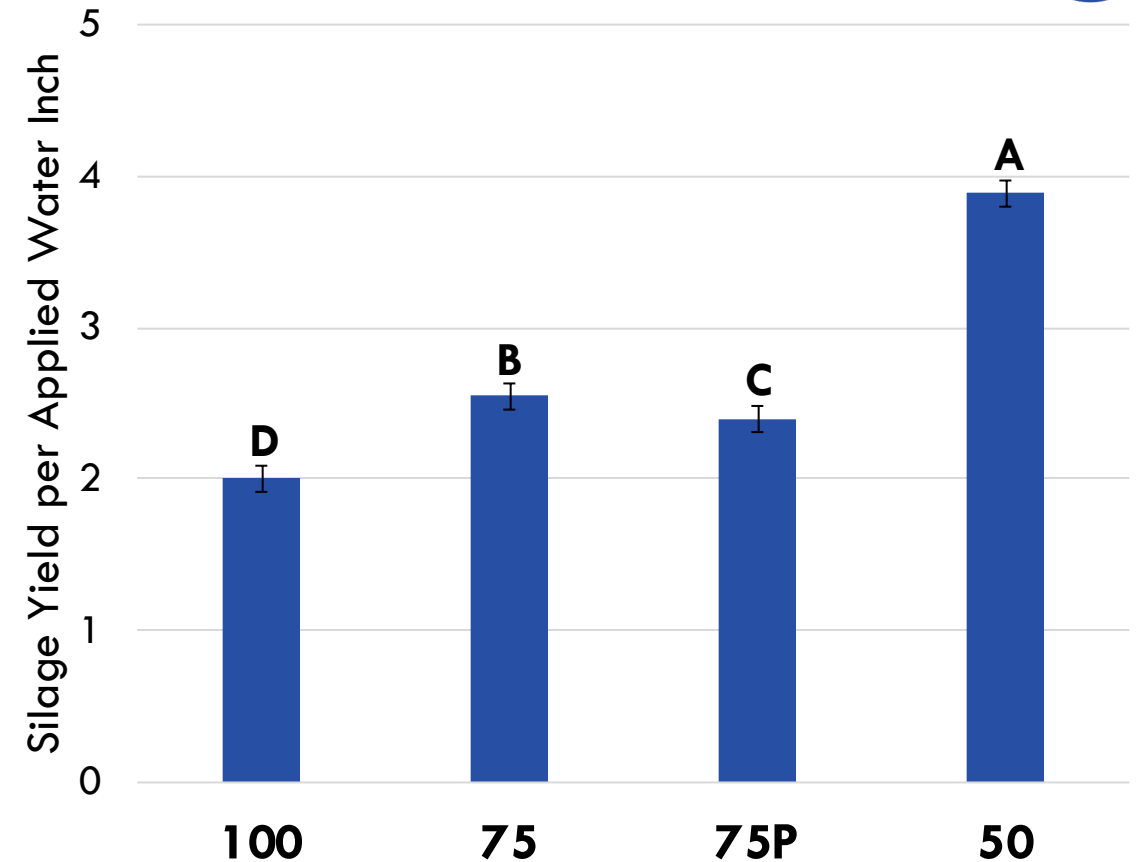
# IRRIGATION RATE EFFECTS



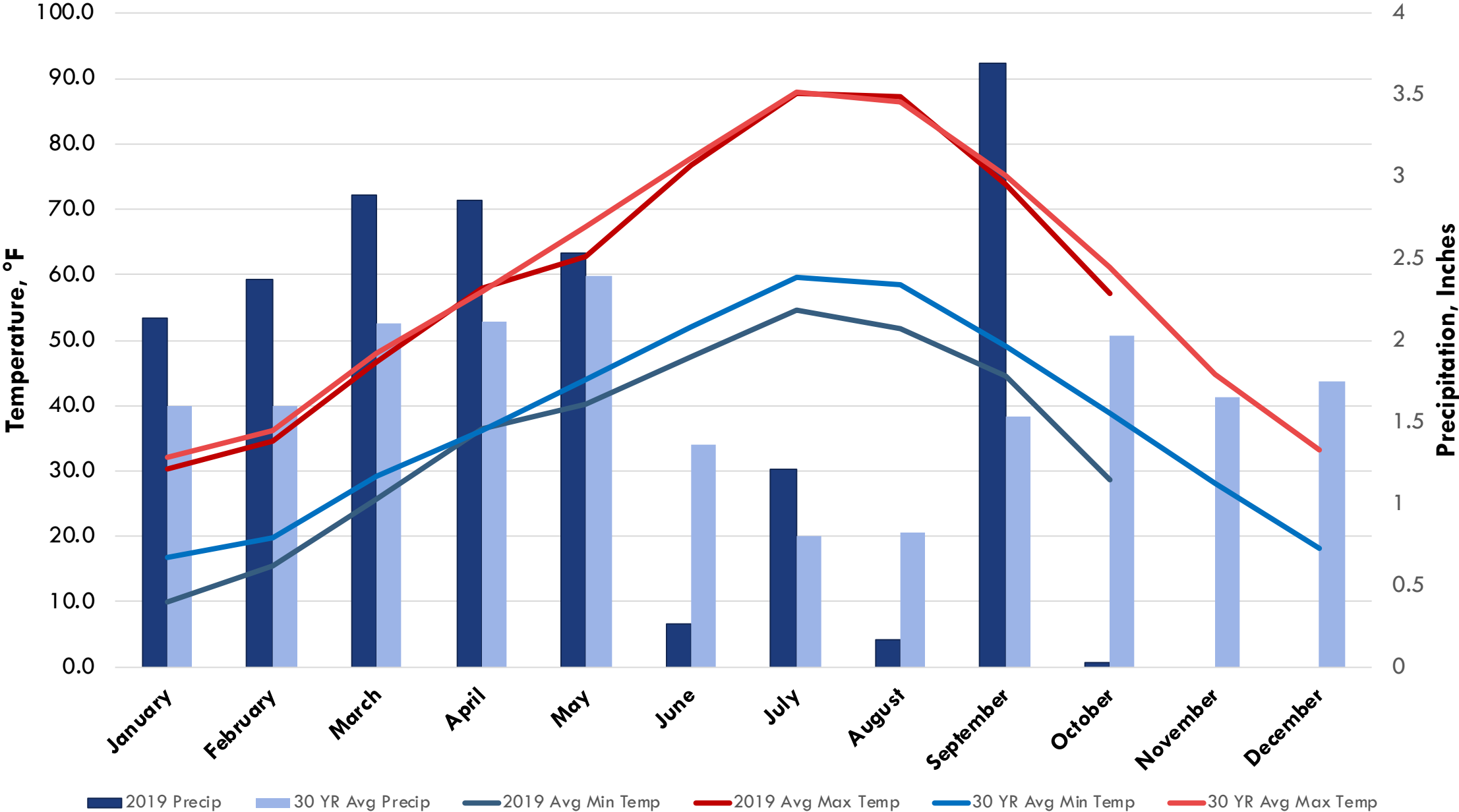
## Yield - Irrigation Rate



## Irrigation Productivity - Irrigation Rate

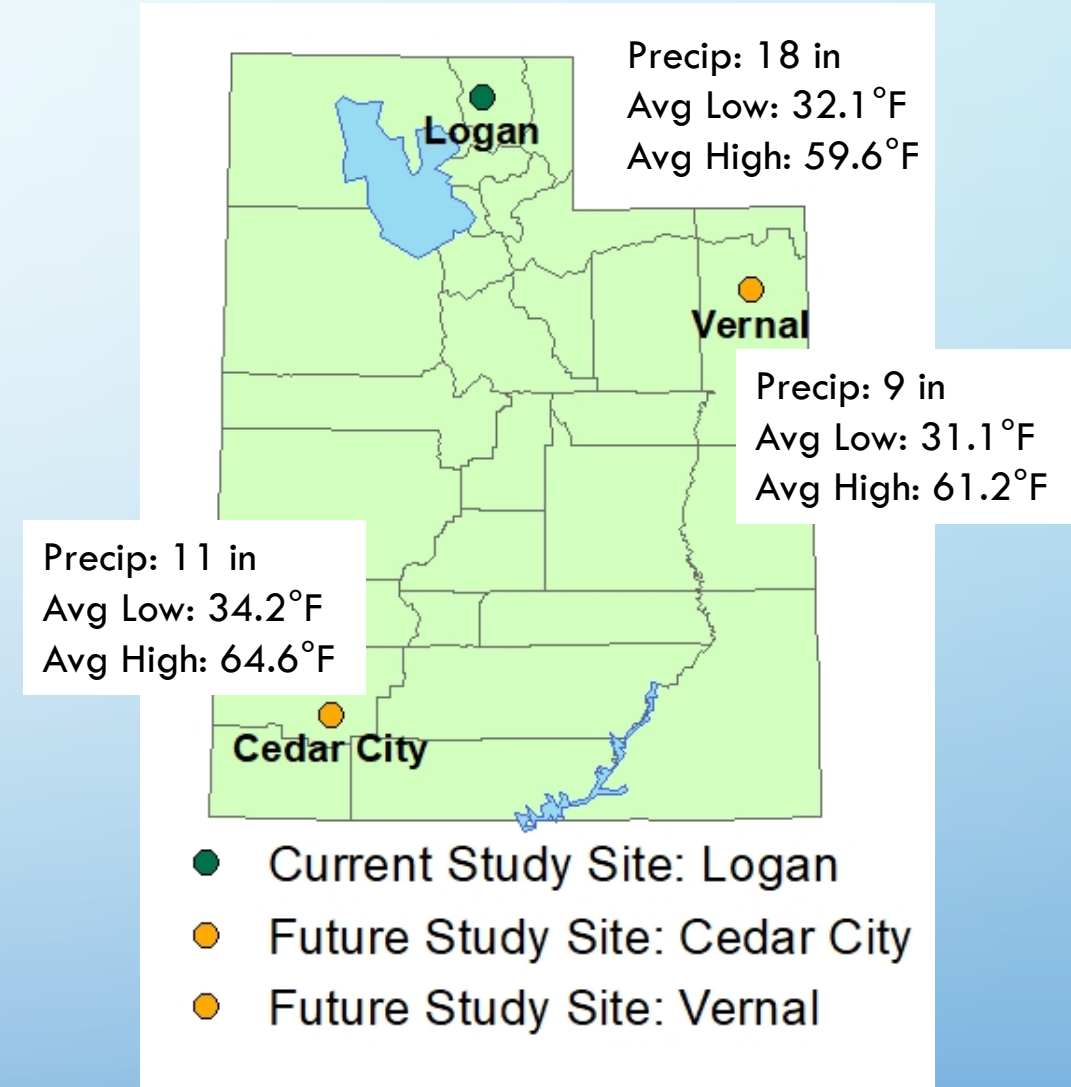


2019 Weather vs 30 Year Averages



# Conclusion & Continuation

- 2019 Logan Site Summary:
  - Relatively wet growing season, likely diluted impacts of our water stress treatments
  - Irrigation rate had the largest impact on yield, suggesting rate adjustments may have greater potential to optimize water use than other approaches tested
- 2020 Logan Site: Additional soil management practices and crops
- 2020 Additional Site: Vernal, Utah
- 2021 Additional Site: Cedar City, Utah



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