Comparative Effects of Deficit Irrigation in Landrace and Commercial Chile (*Capsicum annuum*) Cultivars

Presented by:

Stephanie Walker

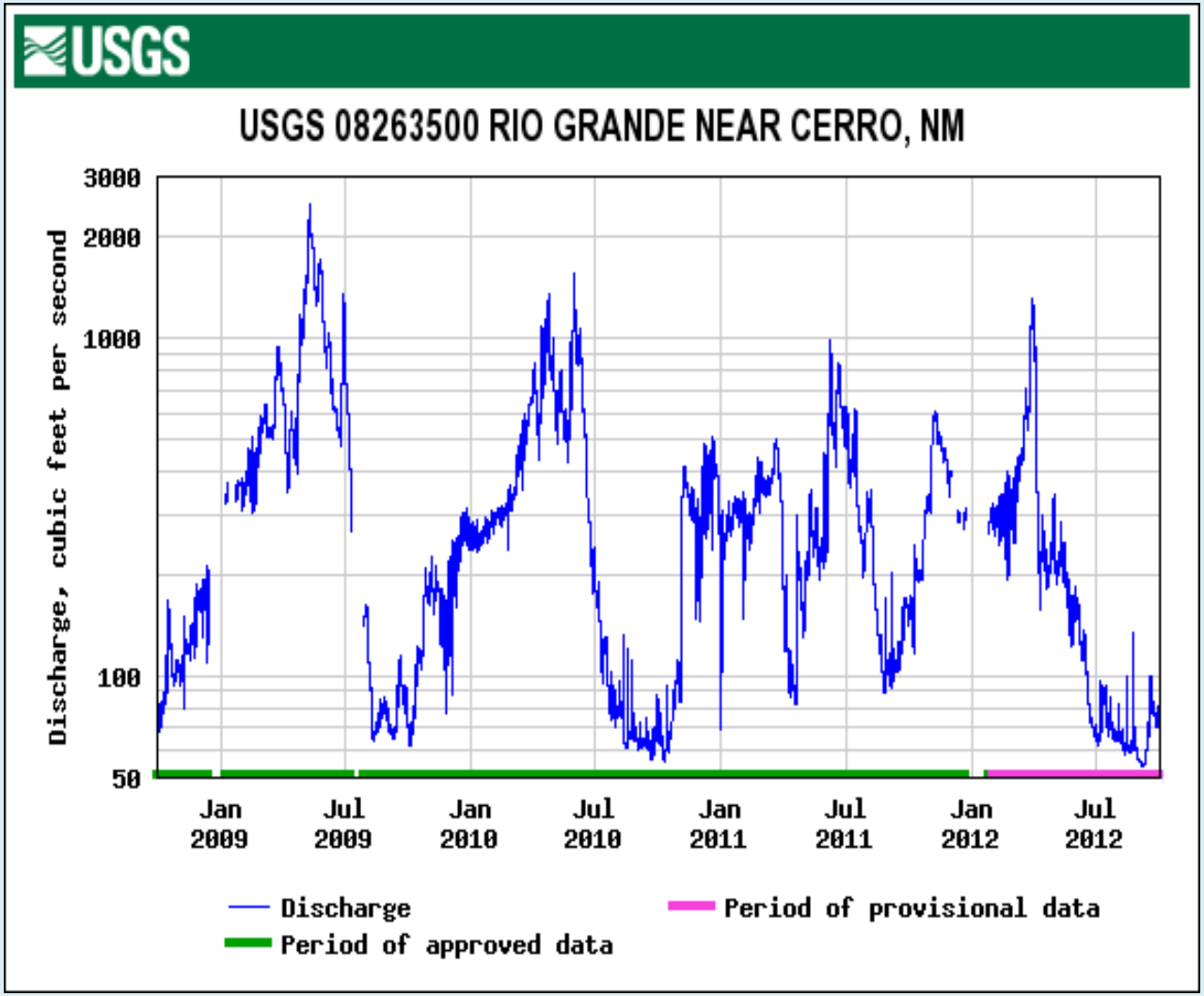
Extension Vegetable Specialist

Background

- Approx. 700 hundred acres of chile peppers (*Capsicum annuum* L.) are grown in north central New Mexico
  -Market value of 1.5 million dollars
- Surface water (70% of which is used for agriculture) comprises 74 % of the water supply to the region
  -Vulnerable to drought and watershed health degradation
- 2010 - 2011 were driest consecutive water years and Jan-Oct; 2012 have been the 9th driest first six months of a year for New Mexico
- Research on chile pepper water use and growth is limited in New Mexico

Project Location

Rio Grande River Discharge (cfs) 2009-2012



Landrace Definition

Definition: An autochthonous variety with a high capability to tolerate biotic and abiotic stress, resulting in a high yield stability and intermediate yield level under low a low input agricultural system. (A.C. Zeven, 1998)

– Chimayo chile; geographic origin: Chimayo, NM

Chimayo July 2011

New Mexican Landrace Chiles

- Developed in communities in northern New Mexico
- Renown for excellent flavor
- Pods tend to be short (< 4 in.), thin walled
- Usually medium to very hot pungency
- Early maturing; adapted for short growing season

New Mexican Landraces

- ‘Chimayó’
- ‘Alcalde’
- ‘Cochiti’
- ‘Escondida’
- ‘Isleta’
- ‘Jarales’
- ‘Jemez’
- ‘Nambe Supreme’
- ‘San Felipe’
- ‘San Juan’
- ‘Santo Domingo’
- ‘Velarde’
- ‘Zia Pueblo’

Landrace Jemez

‘Chimayó’

- Best known, most widely grown of the landraces
- Pod length up to 3.5”
- Early maturing
- Medium pungency
- Mostly used for red powder; some green harvest

Commercial Cultivars

- ‘NuMex Big Jim’
  - Released in 1975
  - Long, thick-walled fruit
  - 500-2,000 SHU
- ‘NuMex Sandia’
  - Released in 1956
  - 1,500- 2,000 SHU

Santa Fe Farmer's Market, 2011

Study Objectives

- To evaluate physiological responses of chile landrace, Chimayo, and commercial cultivars NuMex Big Jim and NuMex Sandia to deficit irrigation

  - Hypothesis: ‘Chimayo’ will sustain optimum yield under deficit irrigation compared to the commercial cultivars

Study Deficit Irrigation Methods

- **Definition of deficit irrigation:** Application of water below full crop-water requirements
  - Two Types:
    - Sustained Deficit Irrigation- below water requirements applied throughout season
    - Regulated Deficit Irrigation- below water requirements applied during specific growth periods

- **Irrigation in north central New Mexico**
  - Irrigation water comes from traditional acequias
  - Flood/surface irrigation recharges the shallow groundwater aquifers that return water to the river systems
  - Historically farmers have always used flood irrigation to water

Study Location

New Mexico State University Sustainable Agriculture Science Center in Alcalde, NM

Materials and Methods

Construction of Armin Poly Pipe Flood Irrigation System May 2011

Single Irrigated Treatment July 2011

Insertion of Flood Gate May 2011

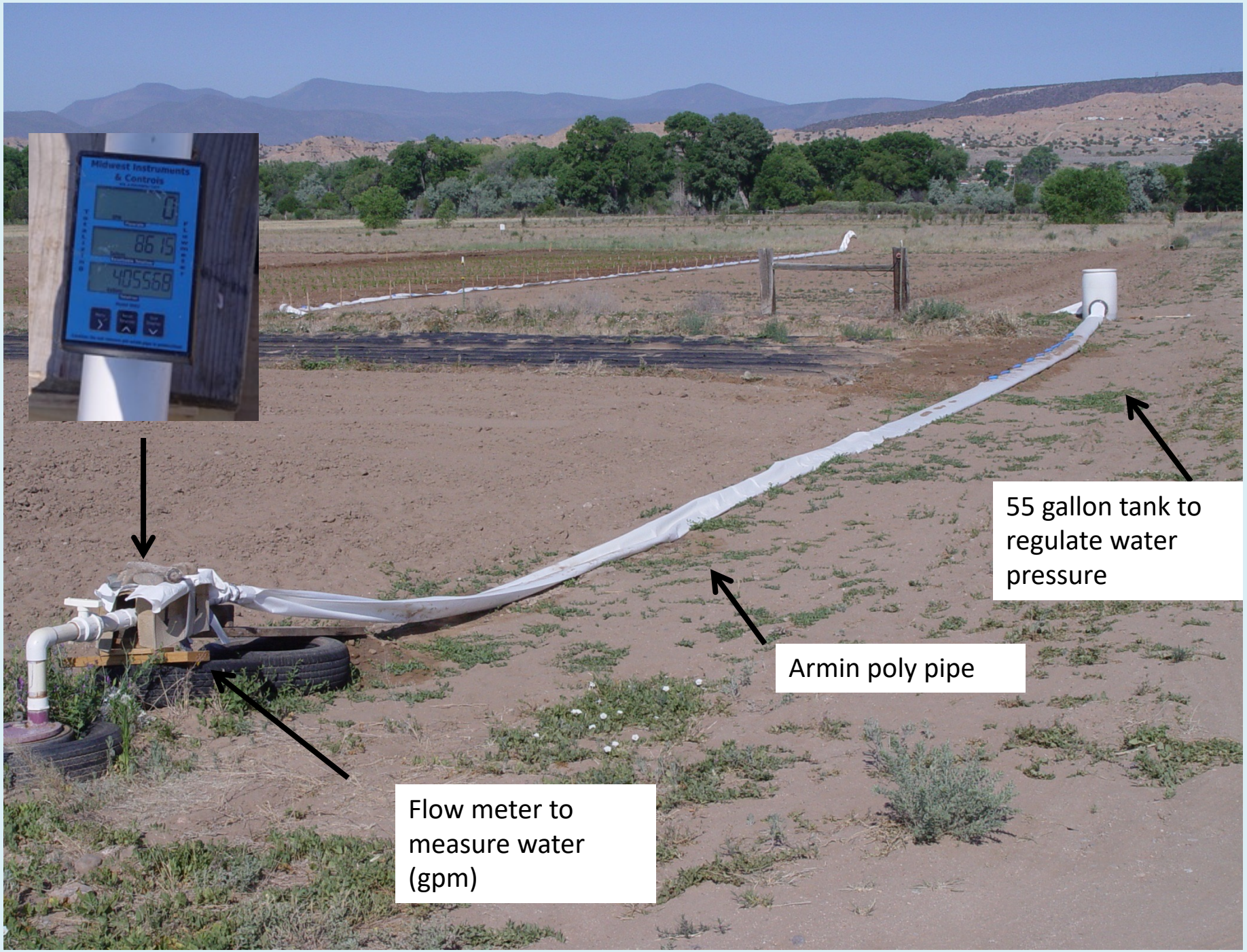
Experimental Design

- Four water treatments were replicated three times:
  - Irrigation schedule using varied interval
    - 7 days (optimal water- 100%)- determined by interviewing farmers in the area
    - 9 days (78 %)
    - 11 days (64%)
    - 13 days (52%)

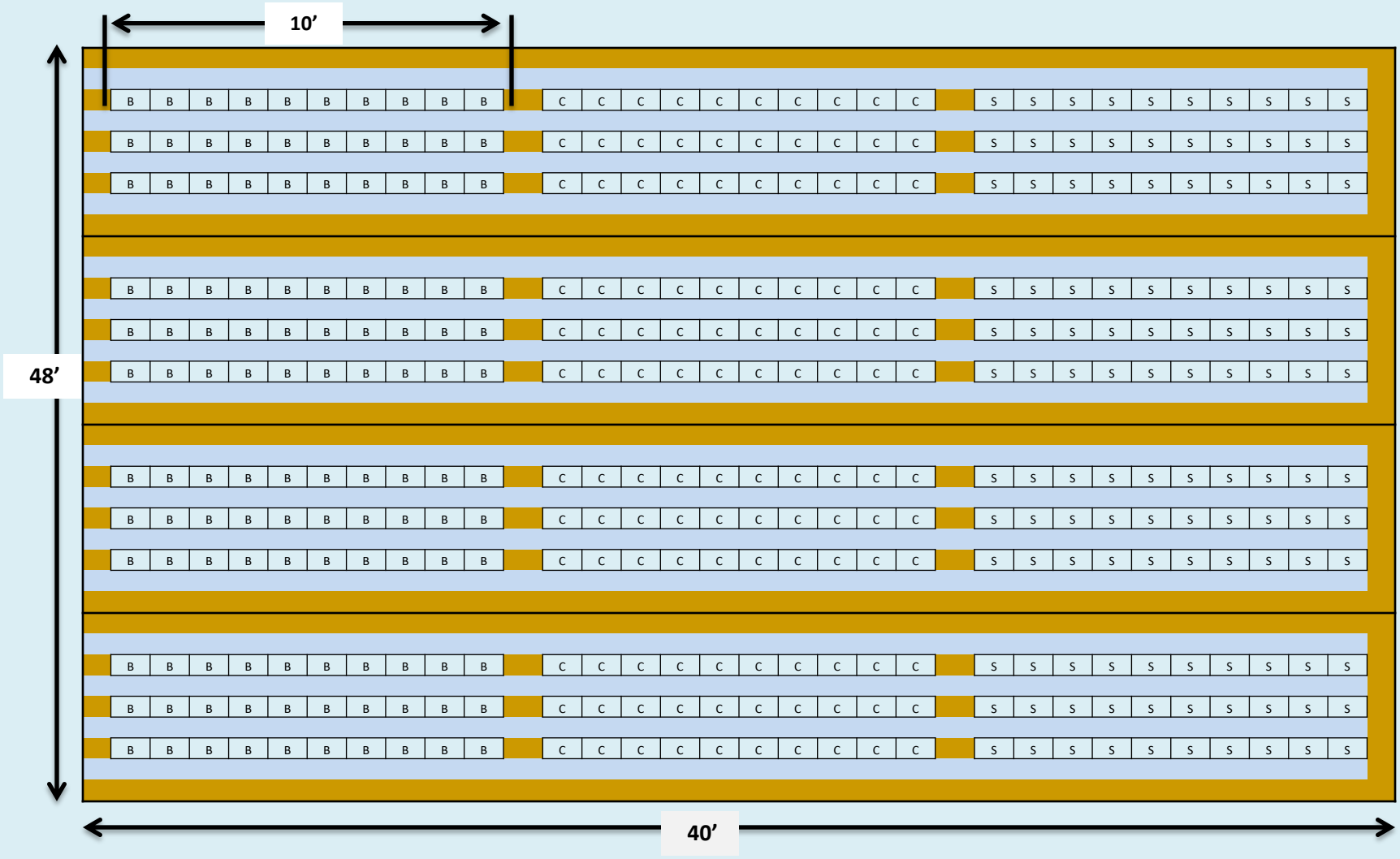
- Four replications of a randomized complete block split-plot design every year.
- Factors were defined by:

  -Cultivar type (subplot factor)

  -Water treatment (whole plot factor)


Midwest Instruments & Controls
0
8615
405568
55 gallon tank to regulate water pressure
Armin poly pipe
Flow meter to measure water (gpm)

Measurements and Design of One Block



B- Big Jim C- Chimayo S- Sandia
Not Drawn to Scale

Data Collection

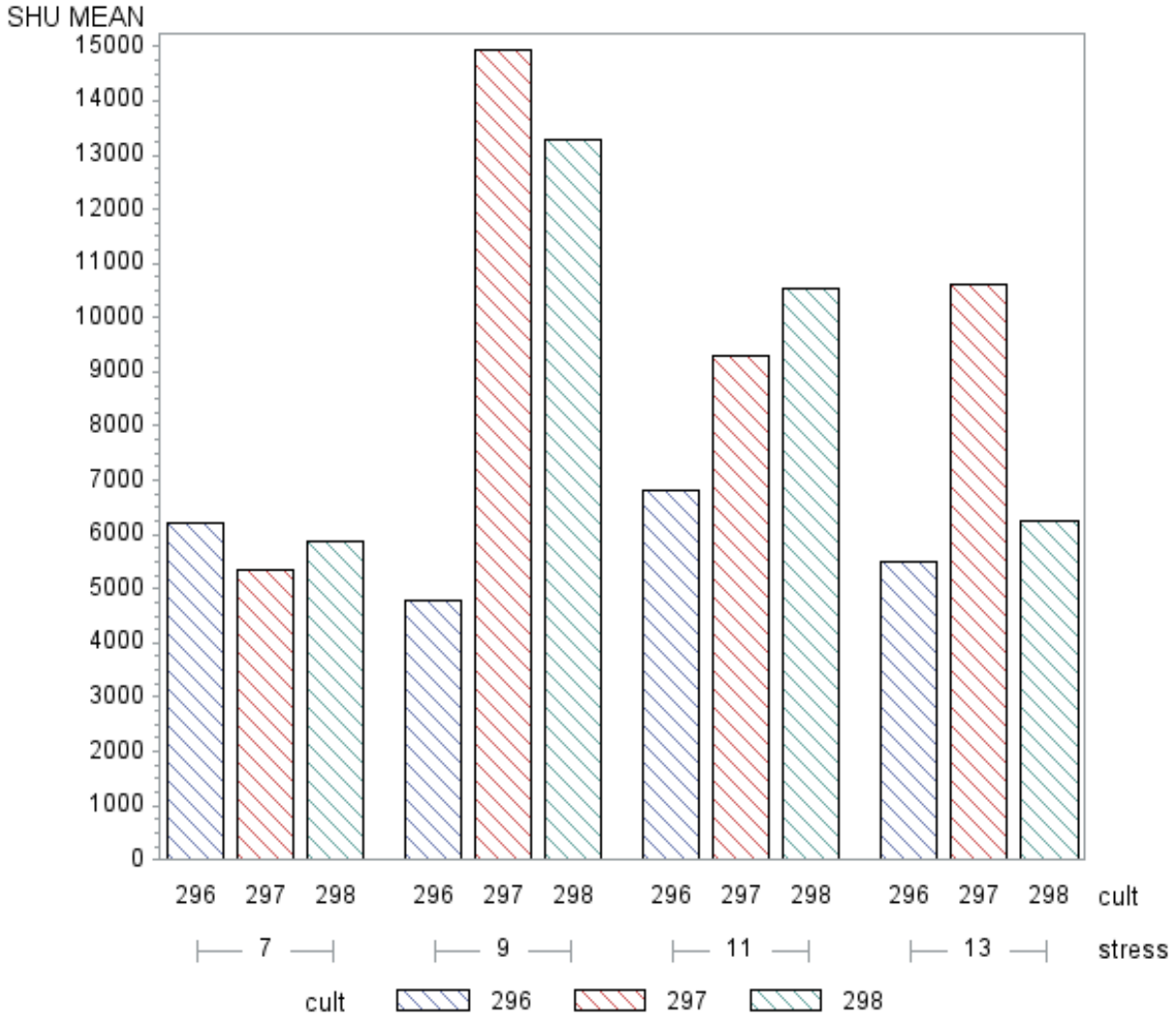
- Fresh green and red yield (kg)
- Dry red yield (kg)
- Scoville heat units (SHU)
- Extractable color (ASTA)
- Above ground biomass (kg)
- ‘NuMex Big Jim’ fruit dimensions
  - Wall thickness
  - Pod length
  - Locule number

The Results

Harvested Chimayo

2011 Pungency Means for Cultivars

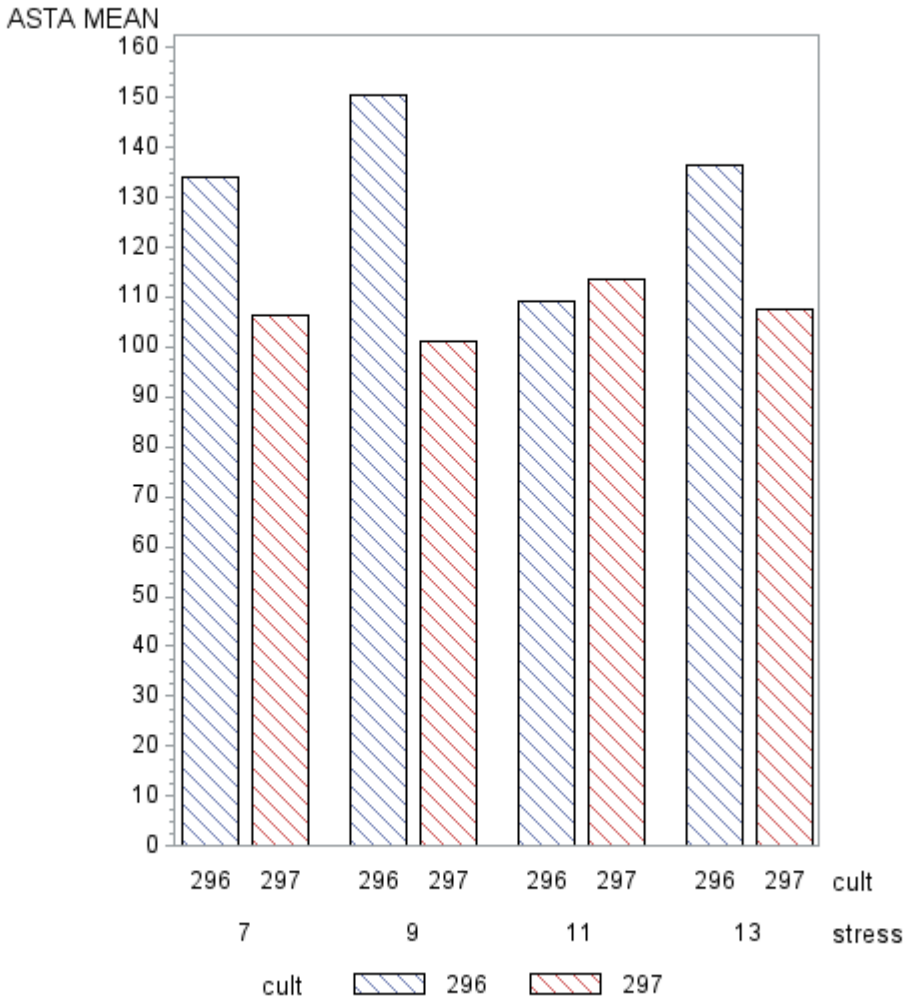
296 = Chimayo , 297 = Sandia , 298 = Big Jim



Pungency in Scoville Heat Units (SHU)

2011 ASTA Means for Cultivars

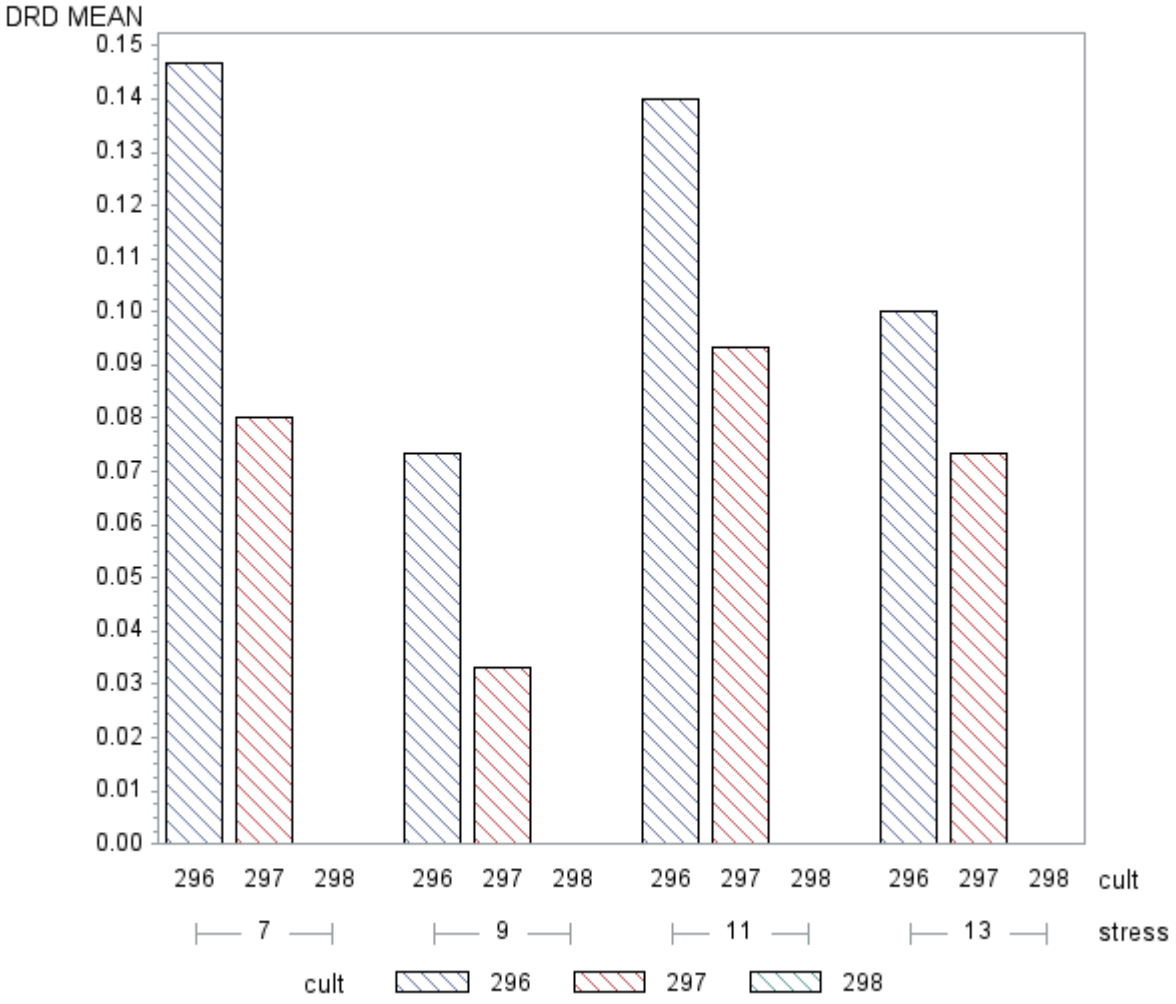
296 = Chimayo , 297 = Sandia



Extractable Color

2011 Dry Red Weight Means for Cultivars

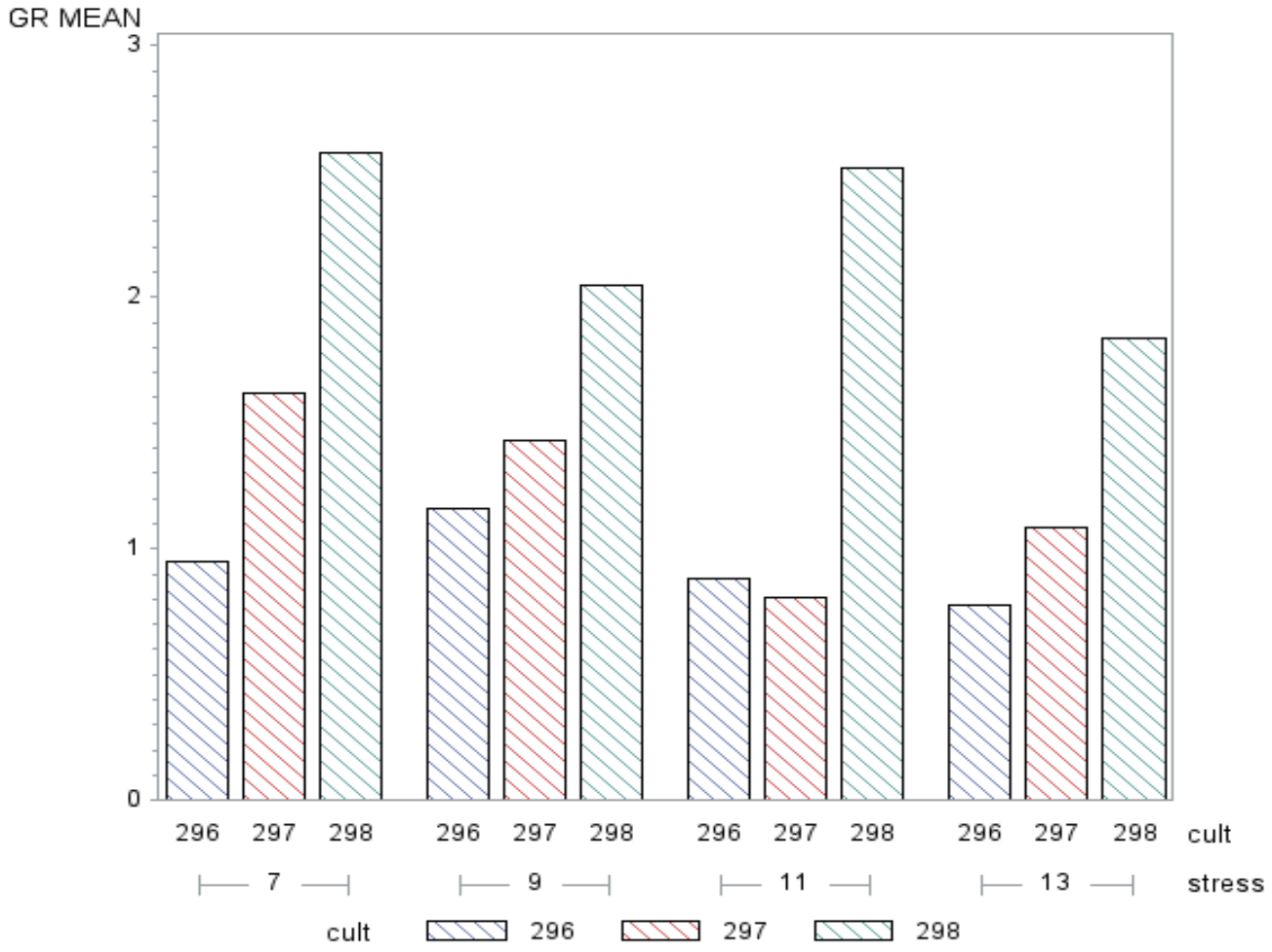
296 = Chimayo , 297 = Sandia , 298 = Big Jim



Weight in Kilograms

2011 Green Weight Means for Cultivars

296 = Chimayo , 297 = Sandia , 298 = Big Jim



Weight in Kilograms

Conclusions

- Yield and quality were not significantly impacted in ‘Chimayo’ under the deficit irrigation levels applied in this experiment
- Yield and quality appear to be less stable in commercial cultivars under the deficit irrigation treatments, but impacts were not significant (P=0.05)
- Further water use efficiency studies are needed to determine ‘how low we can go’ regarding water inputs

Acknowledgements

- Israel Calsoyas, M.S. Graduate Student
- New Mexico State University Agricultural Science Center, Alcalde, NM
- New Mexico EPSCoR Program
- Dr. Steve Guldan
- Dr. Robert Steiner
- Dr. Zohrab Samani