Research Progress towards Mechanical Harvest of New Mexico Pod-type Green Chile

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Introduction – New Mexico Chile

- NM pod type chile peppers (C. annuum)
- Introduction with ‘New Mexico No. 9’ release by Fabian Garcia in 1913
- Also referred to as ‘Hatch’ and ‘Anaheim’ chile

Fabian Garcia
Introduction – New Mexico Chile

• **Red** (physiologically mature) and **green** (full sized, physiologically immature) chile

• Quality attributes differ; different cultivars developed for red vs. green chile production

• NM red chile mostly mechanized
NM Green chile is currently 100% hand-harvested

Photo courtesy of P. Funk
NM Chile Mechanization

- Commercial production of NM green chile threatened because of labor challenges
- Mechanization is critical to sustaining domestic NM green chile production
Challenges to Mechanical Harvest of NM Green Chile

• Lack of mechanical de-stemmer
• Excessive fruit damage
• Excessive field loss / fruit left in field
• Excessive harvested trash (sticks & stems)

• Currently available NM green chile cultivars not optimum for mechanical harvest
Previous Research

• Evaluation of commercial and experimental chile harvester heads
  – Etgar (unmodified) provided the highest recovery of undamaged, marketable NM green chile fruit of those tested

• Determination of best production protocols
  – Irrigation method, seed vs. transplant, plant spacing
Previous Research

• Evaluation of commercially available NM green chile cultivars
  – Some had higher MH efficiency; ‘NuMex Joe E. Parker’ highest MH yield of those tested

• Determination of breeding objectives (key plant architecture traits for increased mechanical harvest efficiency)
  – Taller plants, fewer basal branches, higher height to bifurcation, thicker stems
Current Research

• Development of NM green chile cultivars with improved mechanical harvest efficiency
  – Less fruit breakage
  – Less harvested trash (sticks & stems)
  – Less fruit left in field after harvest
  – Fruit with easier pedicel removal
  – Maintain excellent flavor and fruit characteristics for NM green chile
Objective (2017 Season)

Evaluate advanced, open-pollinated New Mexico green chile breeding lines developed for mechanization efficiency
Materials and Methods

• Six advanced New Mexico green chile breeding lines: 54W17, 55W17, 57W17, 58W17, 60W17, 61W17

• Two commercially available New Mexico green chile cultivars: NuMex Joe Parker, AZ-1904

• Lines all open-pollinated
Materials and Methods

- Field was direct seeded 4 April 2017 at the Los Lunas Agricultural Science Center (Los Lunas, NM)
- Plots were 40’ long; randomized in a complete block design with seven replications
- Field was furrow-irrigated (30” furrows), thinned (8” plant spacing), and maintained according to local production protocols
Materials and Methods

- Plots (inner 30’) were harvested 29 August 2017
- Single row, Etgar double open-helix picking head powered by tractor used for harvest
Materials and Methods – Pre-harvest

- Plant Measurements (Avg. of 6 plants/plot):
  - Height
  - Width
  - Distance to bifurcation (primary branch angle)
  - Internode length
  - Stem diameter
  - Number of basal branches
Materials and Methods – Post-harvest

• **Mechanically Harvested Yield Components:**
  - Marketable green fruit
  - Damaged fruit
  - Trash (sticks and leaves)
  - Red fruit, diseased fruit

• **Field Loss:**
  - Fruit dropped on ground
  - Fruit left on plants
Materials and Methods – Fruit Quality

- Marketable Green Fruit (Avg. of 10 fruit/plot):
  - Fruit width
  - Fruit length
  - Number of locules
  - Pericarp (fruit wall) thickness
  - Flavor & heat
Materials and Methods – Statistical Analysis

• Analysis of variance to detect significance at $P \leq 0.05$

• If significant, means were separated by Least Significant Difference Test ($P \leq 0.05$)
Results
Results: Plant Architecture

![Bar chart showing plant architecture results](chart.png)
Results: Harvested Marketable Fruit
Results: Harvested Damaged Fruit & Trash
Results: Field Loss

![Bar chart showing field loss results for different cultivars.](chart.png)
Conclusions

- Fruit damage and harvested trash (sticks and leaves) tended to increase with higher marketable fruit yield.

- Breeding line 54W17 provided best mechanical harvest:
  - Significantly greater distance to bifurcation and thickest stem diameter (data not shown).
  - Highest marketable fruit yield, but not significantly different than Joe E. Parker.
  - Significantly less field loss (unharvested fruit remaining on the plants and ground fall losses) compared to AZ-1904 and Joe E. Parker.
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...Questions?