Economic and Environmental Benefits of Compact Bed Geometry for Plasticulture Sanjay Shukla, Nathan Holt, Kira Hansen

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The Idea



Compact







Motivation Can *compact beds* make plasticulture more efficient?

Input

- ➤ Water
- Nutrients
- > Cost
- Fumigant





Output ≻ Yield



S2: 2013-2014

Water and Nutrients

- Same rates
- One drip tape
- Preplant + liquid fertilizer



Experimental Area



Commercial Farm

 \geq ≈ 2 acres, 36 beds

Statistical Setup

> Incomplete randomized block design (C)



T1-6: Treatment 1 – Replication 6

Copyright: Shukla and Holt

Monitoring

Hydrologic









Water Table

Data Collection and Storage

Real-time data (15 min.) throughout seasons

Climate

 Rainfall, wind speed, solar radiation, temperature, and humidity



Weather Station



Data Collection



In-Field Data Logger

Monitoring

Plant

Growth

- Leaf-Area-Index (Bi-weekly)
- Plant Height

Leaf Tissue

N, P, and K (Bi-weekly)

Yield

Three harvests (USDA grade)



Yield Copyright: Shukla and Holt

Soil

Solution

- \blacktriangleright NH₄-N and NO_x-N (Bi-weekly)
- In and below root zone

Bed Firmness

Bulk Density



Soil Solution

Tissue



- Differences in yield not significant with improved bed firmness
- Treatments were not water or nutrient limited
- No measured differences in growth (LAI and Plant Height)



Economic Benefits





- 11. FBreadlingight
- 22. Dissesevious Area





Seeing the Benefit

- Immokalee Fine Sand
- 1 hour, 0.34 GPM/100 ft.

• Wetted Width: 11 in.

• Wetted Depth: 9.5 in.





Eggplant

Beds



24 in x 10 in 1 Tape 36 in x 6 in 2 Tapes 18 in x 12 in 1 Tape

51 Days After Transplant



24 in x 10 in

36 in x 6 in

5 in 18 in x 12 in

Reductions 50% Irrigation
14% Nitrogen
11% Phosphorus 73 Days After Transplant





Soil Moisture



Eggplant Results



Production Cost	36 in x 6 in	24 in x 10 in	18 in x 12 in
Drip Tape (\$/acre)	\$255	\$128	\$128
Fuel Cost (\$/acre)	\$27	\$14	\$14
Cost of Fumigant (\$/acre)	\$260	\$174	\$129
Net Production Cost Savings (\$/acre)	-	\$227	\$273

*Conservative (Additional Potential Savings: Liquid Fertilizer, Labor, Lease)

What We Know

System

Efficiency

More Crop per "Drop"

Economic









->Environment







What We Are Doing Now

Single-Row Crop: Tomato





Double-Row Crop: Pepper





Hydrological Impact Study

> Other Crops: Melons, Squash, Herbs

> Applicability Across United States?, Implemented in FL, GA, and SC



Extend out flat piece

New Bedder



Improvements







New Plastic Machine



Then Improvements

Now

Tomato Season 1









What We Are Looking For

Drip Fumigation







Hydrology (Current and Future)



Disease



Tomato Experiment



Pepper Experiment







- 2015, 2016

Fall

> Transplant:

- October 2, 2015





Standard Tie vs. Loose Tie









Pepper Yield Preliminary Results

First Harvest

- November 30, 2015
- Grades and Weight
- No Statistical Differences Between Bed Geometries









- More suited than tomato? vine vs staked
- Narrower than 16 in?
- Reduced cost, water, nutrient, and disease risk
- More plants/ac, reduced leasing cost

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