

# Compact Bed Plasticulture for Decreased Environmental and Economic Footprints



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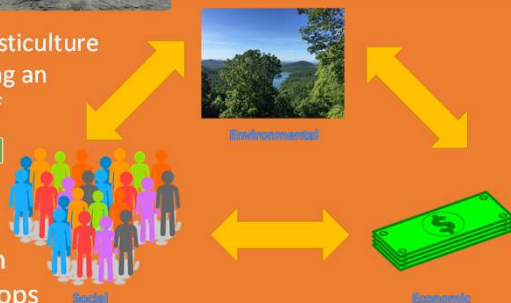


## Background



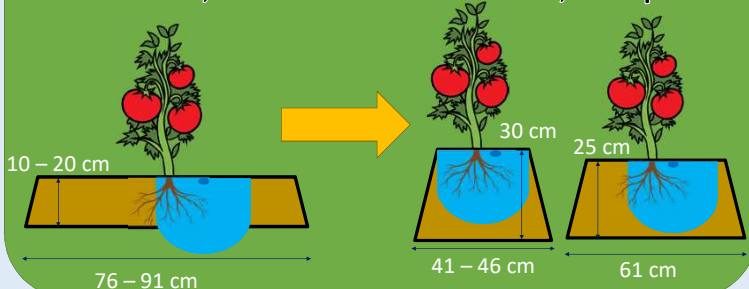
Raised bed plasticulture is the use of plastic films (mulch) in agriculture for fruit and vegetable production (e.g. tomato and strawberry).

- 680,000 ha of plasticulture in the U.S. grossing an annual average of **\$10 BILLION**
- Much higher inputs and production than conventional crops
- 2.5 million metric tons of plastic used globally in 2005 and increasing to meet the increased food demand
- System designs needed to rethink the space under the plastic to reduce inputs and maintain production



## Objective

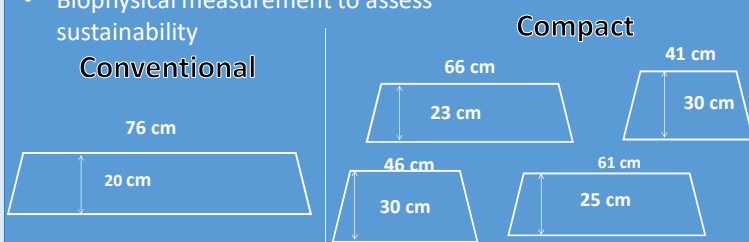
Conventional; Short & Wide      Novel; Compact



## Methodology

- Field experiments and hydrologic modeling at commercial vegetable farms to evaluate compact beds against the conventional wide-short beds
- Everglades watershed; sub-tropical, sandy soils, and drip irrigation
- Producers managed inputs (nutrient, water, pesticide)
- Biophysical measurement to assess sustainability

Crop	Row	Seasons
Tomato	1	2014-2017
Eggplant	1	2014
Pepper	2	2016-2017



$$P_r^{weight} = \frac{\text{Marketable Yield (kg)}}{\text{kL irrigation, kg N, or kg P}}$$

## Results

### NO REDUCTION IN YIELD FOR ALL CROPS AND YEARS

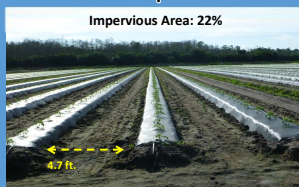
#### Hydrologic Benefits

- 5% reduction in irrigation leaching with taller beds, increasing residence time of irrigation water in the bed

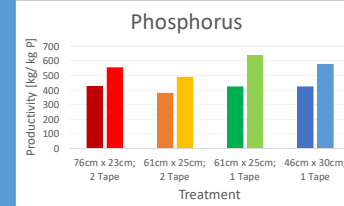
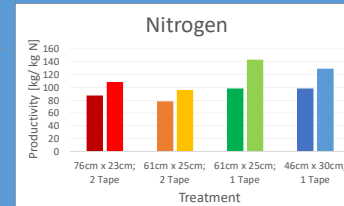
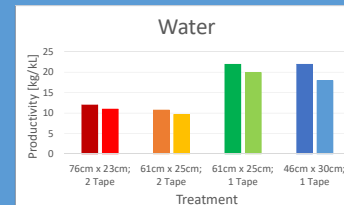
#### Conventional



#### Compact



#### Environmental Benefits



26% Runoff

#### Disease Reduction

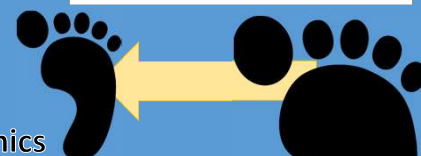
- Decreased incidences of water vectored diseases (i.e. *Phythora capsici*)

#### Economics

Production Cost	91 x 23 cm	61 x 25 cm	61 x 25 cm	46 x 30 cm
Drip Tape (\$/ha)	\$637.5	\$637.5	\$320	\$320
Fuel Cost (\$/ha)	\$67.5	\$67.5	\$35	\$35
Cost of Fumigant (\$/ha)	\$650	\$435	\$435	\$322.5
Liquid Fertilizer (\$/ha)	\$187.5	\$187.5	\$107.5	\$107.5
<b>Net Production Cost Savings (\$/ha)</b>	-	<b>\$215</b>	<b>\$645</b>	<b>\$758</b>
<b>Savings per Kilogram Yield (\$/kg)</b>	-	<b>\$0.02</b>	<b>\$0.05</b>	<b>\$0.06</b>

\*Conservative (Additional Potential Savings: Labor, Lease)

- Compact beds can enable more plant per area by using extra row space to increase production with same farm land



5-10% less carbon

## Conclusions and Impacts

- Reduced input with no yield reduction
- 5% to 50% reduction in irrigation volume
- Reduced flooding and associated benefit of reduced disease and downstream nutrient loadings, serve as climate change adaption
- Economically attractive for producers, already implemented on more than 20,000 acres along the east coast of the US
- Conservatively save U.S. producers more than **\$200 MILLION/ YEAR**
- Potential for increased production per land area, important for costal regions with high land value
- Can transform food-water-energy-land-economic nexus