



## Celery Variety Trial: Preliminary Results, July 2018

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### Introduction

Celery (*Apium graveolens*) is an aromatic vegetable in the parsley and carrot family. Celery is rich in Vitamins A, C, and K, as well as minerals like potassium, calcium, and magnesium. It is also a source of antioxidants and anti-inflammatory phytochemicals. Celery is a cool, long-season crop, preferring temperatures of 60-70°F and requiring about 120-150 days from seeding to harvest.

The largest producers of celery in the United States are California (2005: 25,000 acres, \$256 million), Florida (2007: 8,000 acres, \$39 million), and Arizona (2007: 1000 acres, \$1.2 million) (Daugovish et al. 2008; SIPM Center 2007; UA CALS 2001). In the 1950's and 1960's, Hawaii produced modest amounts of celery, with a maximum of about 2.4 million pounds annually from 50 acres (Mollett 1963). However, currently majority of Hawaii's celery is imported.

In December 2017, a program under the Hawaii Department of Public Safety expressed their interest in growing celery to offset imported purchases. Import replacement, such as with celery, can greatly benefit Hawaii's economy and agriculture, with 10% replacement of current imports resulting in estimated \$188 million in sales, \$6 million in state tax revenues, and 2,300 jobs (Leung and Loke 2008). To address this grower's need and examine the potential of celery import replacement, this variety trial evaluated the growth characteristics and feasibility of producing nine commercially available celery varieties in Hawaii.



### Varieties Evaluated

NAME	STALK TRAITS	RESISTANCES	SUPPLIER
<b>Calypso</b>	Crisp, mild flavor	Fusarium wilt	High Mowing Seeds
<b>Command</b> ( <i>Organic</i> )		Fusarium yellow	Osborne Seed Company
<b>Conquistador</b>	Straight, green	Bolting (tolerant)	Johnny's Seeds
<b>Kelvin F1</b> ( <i>Organic</i> )	Dark green, uniform		Osborne Seed Company
<b>Merengo F1</b>	Dark green, tall	Fusarium yellows	High Mowing Seeds
<b>Tall Utah</b>	Dark green	Rust	High Mowing Seeds
<b>Tall Utah 52-70R Improved</b>	Compact	Brown check, West celery mosaic, bolting; Fusarium yellows (tolerant)	Harris Seeds
<b>Tango</b> ( <i>Organic</i> )			Harris Seeds
<b>TZ 6200</b> ( <i>Organic</i> )		Fusarium	Osborne Seed Company



## Methods

### Field Design (Poamoho Research Station, Oahu)

Row #1	#2	#3	#4
Conquistador	Merengo F1	Tall Utah	Kelvin F1
Kelvin F1	T.U. 52-70R	Kelvin F1	T.U. 52-70R
Merengo F1	Calypso	Tango	Conquistador
T.U. 52-70R	TZ 6200	Calypso	Command
Tall Utah	Conquistador	Conquistador	Tall Utah
Tango	Tango	TZ 6200	TZ 6200
Command	Command	T.U. 52-70R	Calypso
Calypso	Kelvin F1	Merengo F1	Merengo F1
TZ 6200	Tall Utah	Command	Tango



### Planting, Harvesting

- 4 double-row plots per variety (14" apart, 40" between centers)
- 12 plants per row (10" apart, 24 per plot)
- 1' between plots inline
- **Seeded:** January 11  
**Transplanted to field:** April 11 (90 days)  
**Harvested:** July 18 (188 days)  
\*Longer harvest to reach desirable size of 6" or more

### Fertilizer, Irrigation, Weeds

- Soil pH= 6.6
- Requires per acre per crop season  
Nitrogen: 250 lbs (urea, triple 19)  
Phosphorus: 50-100 lbs (triple super P, triple 19)  
Potassium: 400 lbs (muriate potash, triple 19)
  - Weekly 3lbs of triple-19 fertilizer
  - Supplemented with  
Calcium nitrate: 5 lbs  
Borax: 1 lb
- Requires total 2 acre-feet of water (650,000 gallons), more towards harvest
  - Trial irrigated ~780,000 gallons per acre
- Herbicides approved (i.e. GoalTender)

### Data Collection:

Once celery stalks reached appropriate height of at least 6" from the soil line to the first node, plants were harvested over 4 ft lengths on double rows. Measurements taken included the following:

- Marketable weight (~8 plants, remove damaged and pithy stems)
- Average stalk length (average of 3 stems, average base to tip of leaves)
- Average midrib length (average 3 stems, base to first node)
- Stem diameter (average 3 plants, first upright inner stem, 2 inches above base)



**Results**



Fig. 1-4. Yield and size characteristics of nine celery varieties. Red line indicates USDA length criteria for US Extra No. 1 grade (highest). Varieties that do not share a letter are statistically significant from each other.

\*Due to field variation, no statistically significant differences were found for stalk and midrib length and stem diameter



**Merengo**

**Command**

**Tango**

**Calypso**

**Kelvin**

2ft



1ft

**TZ 6200**

**Tall Utah 52-70R**

**Conquistador**

**Tall Utah**

2ft



1ft

Optimal Sizes at Harvest  
 Blue lines on weed mat are 1 ft intervals



## Economic Feasibility (Preliminary)

**Profit= \$28, 288 per acre**

**Revenue= \$50,920 per acre**

- Average 14lbs per 16 sqft. → 38,000 lbs per acre @ \$1.34 per pound → \$50,920 per acre

**Costs= \$22, 432 per acre**

- Seeds: 25k @ \$205 → 48 plants per 40 sq. ft. → 52,272 plants per acre → \$430 per acre
- Fertilizer: \$1853 per acre (May be different with different fertilizer regime)
  - Urea: 0.5 lbs → 16 lbs per acre @ \$25 per 50# → \$8 per acre
  - TSP: 0.5 lbs → 16 lbs per acre @ \$33 per 50# → \$11 per acre
  - Potash: 1 lbs → 31 lbs per acre @ \$25 per 50# → \$16 per acre
  - CaNO3: 2 lbs → 62 lbs per acre @ \$21 per 50# → \$26 per acre
  - Triple 19: 45 lbs → 1,400 lbs per acre @ \$51.20 per 40# → \$1792 per acre
- Water: \$1.89 per 1000 gallons → 778,000 gallons per acre → \$1470 per acre
- Weed (GoalTender): \$466.68 per 2.5 gal → 0.5 pints/acre → \$11.67 per acre
- Labor: 2 hours per week per 1400 sq.ft. @ \$20 per hour @ 15 weeks → \$18,668 per acre (May be different with mechanization, scale)

## Taste Test (17 participants)

Variety	Flavor	Crunch	Non-Stringy	Color	Size
Calypso	2	5	3		
Command		1			
Conquistador		1	1		
Kelvin	4	2	2	1	1
Merengo	1	3	2		2
Tall Utah	1			4	2
Tango	3	1		1	1
TU 52-70R		1			
TZ6200	2	3	3		1

Although varietal sizes may be smaller than commercial US operations, potential for local celery production may be driven by flavor targeted towards restaurants and culinary markets. During a blind, informal taste test, participants assigned one token in each category to the variety that exhibited that trait most. The higher the number, the more desirable the trait by participants.

## Conclusion

This celery variety trial demonstrated the potential for celery production to address import replacement. Although no significant differences were found among majority of the commercially available varieties for yield and size (possibly due to slope variability across the field), visual observations from optimal sizes at harvest showed certain varieties displaying ideal size and shape (i.e. Merengo, Command, and Tango). Regardless, nearly all varieties met the USDA midrib length criteria for US Extra No. 1 grade. Additional trials are required to distinguish clear yield differences and minimize variability.

Based on preliminary calculations, celery production can be profitable at \$28,000 per acre, given the conditions observed in this trial. However, farmers will need to find a suitable market. From the informal taste test, varieties like Calypso, Merengo, and TZ6200 may be suitable for fresh market given crunchiness yet low stringiness. Additionally, participants and local chefs expressed the strong flavors and aromas from the varieties grown as being ideal for cooking and stocks, indicating local celery may be suited towards restaurant and culinary markets. For fresh or restaurant markets, Hawaii celery production is an additional crop that farmers and the agricultural sector can consider for potential added profits, import replacement, and food self-sufficiency.



## REFERENCES

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