



Optimizing Yield and Quality of Hawaii-grown Turmeric

Collection and Evaluation of Curcuma Germplasm

Ted Radovich & Emilie Kirk

J.P. Bingham, J. Calpito, K. Wong, A. Ahmad

College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Kevin Flanagan
SeaSons Organics LLC

Historic Importance

- Food & Flavor
- Medicine
- Dye
- Religious
- Ornamental



Current Situation

- \$6.00/lb Farmgate (Hawai'i 2016)
- Production rapidly expanding (2018 estimate = 60-80 acres statewide)
- Local market easily saturated.
- Increased exports.
- Value addition.



Turmeric

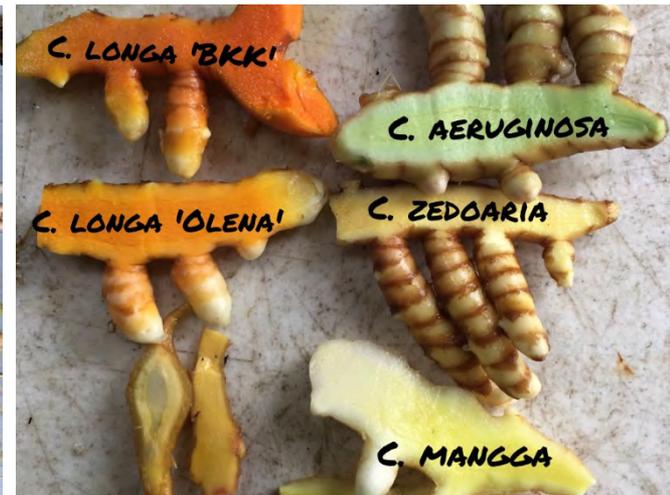
- **Seasonal (April/May-February/March).**
- **600 - 1,500 mm H₂O/season.**
- **Reported nutrient removal (*Ravindran et al., 2007*):**
 - **N: 16.5 kg/t**
 - **P₂O₅: 3.1 kg/t**
 - **K₂O: 44.5 kg/t**
- **Relatively low pest pressure.**



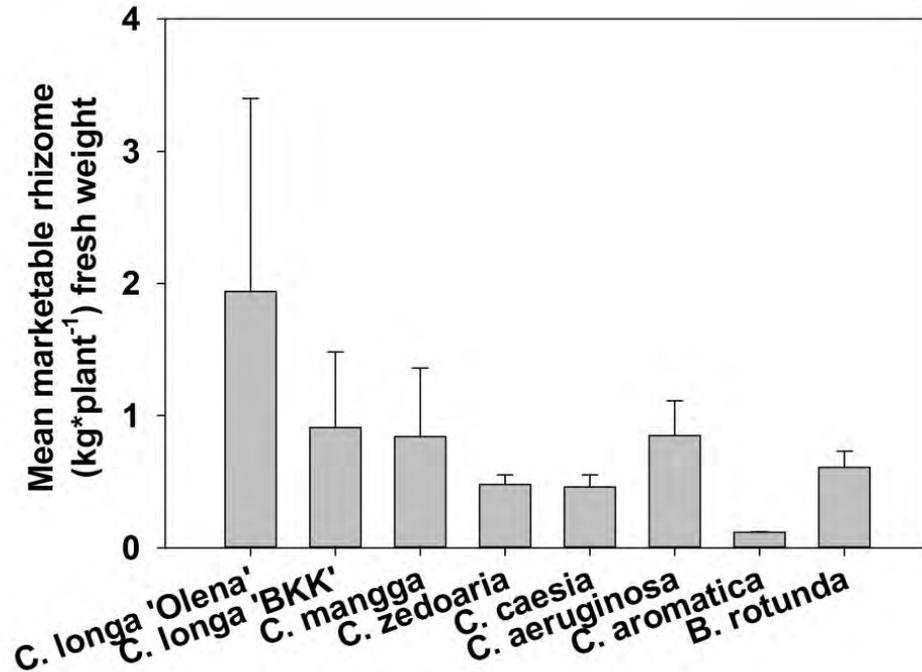
Turmeric, Aquaponic 2015-2016

- **Observational.**
- **Increase familiarity with local germplasm.**
- **Increase planting material.**

<http://www.hawaiianorganicginger.com/>



Turmeric, Terrestrial 2016-2017



Manual Harvest Sucks!!!



Oahu Field Trial 2017-2018

- Planted May 2017.
- Twelve locally collected accessions.
- Harvested January 2018.
- Data collected:
 - Yield
 - [Curcumin]







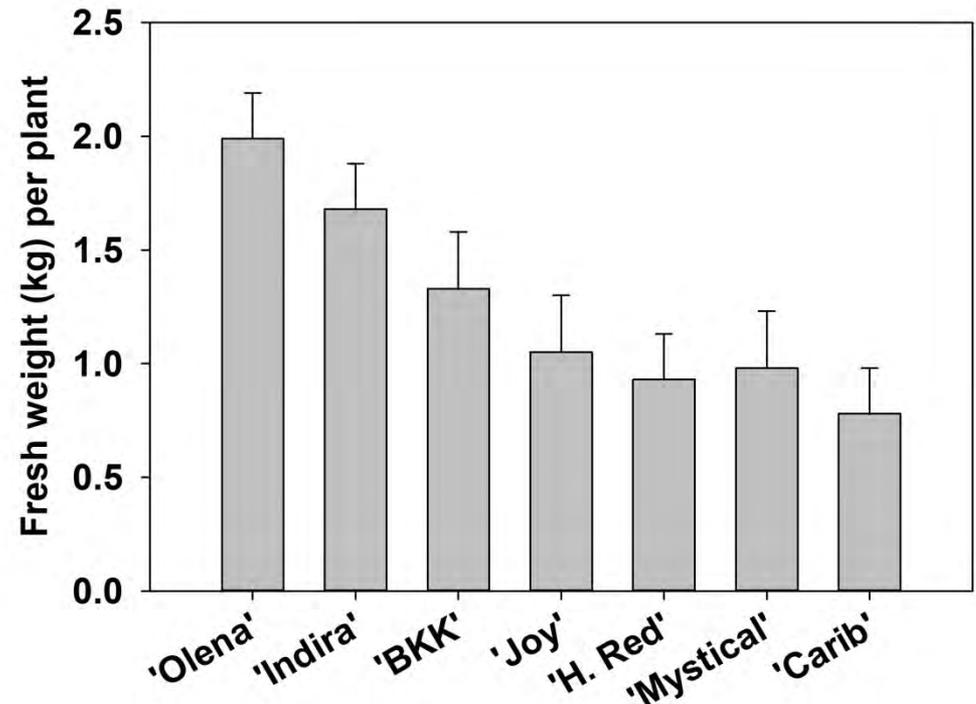






Yield of *C. longa*

- Yields ranged between 0.75 – 2.0 kg of cleaned, marketable fingers per plant.
- Estimated @ ~ 16 - 43 t/ha.
- Reported commercial yield = 13 to 35 t/ha of fresh turmeric.
- Other attributes besides yield important.

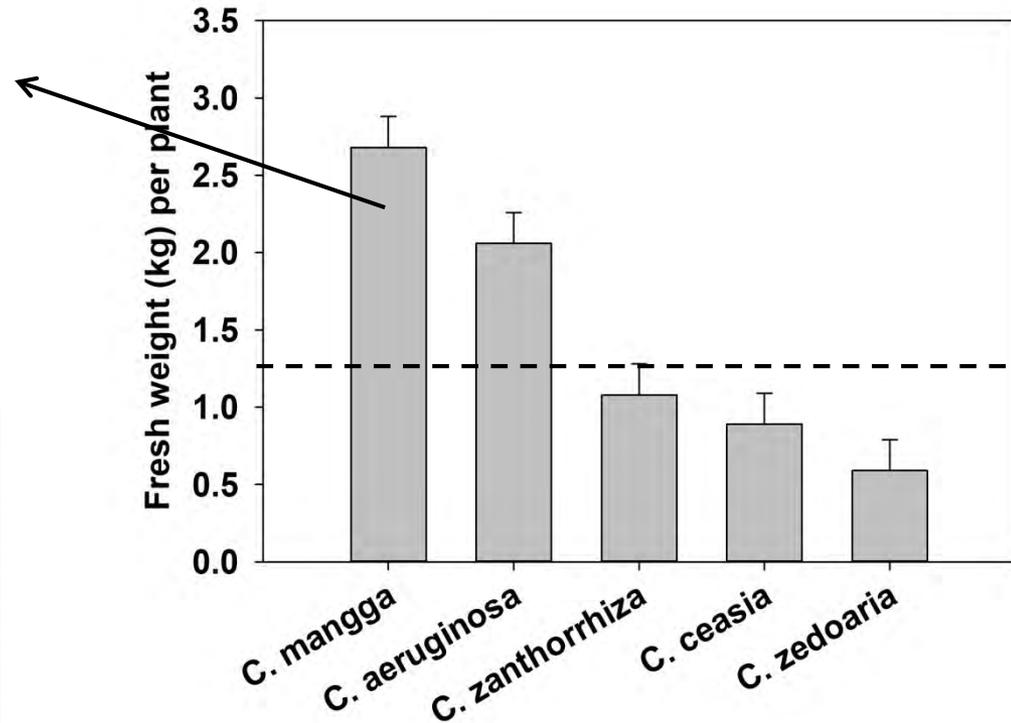


Yield of *C. longa*

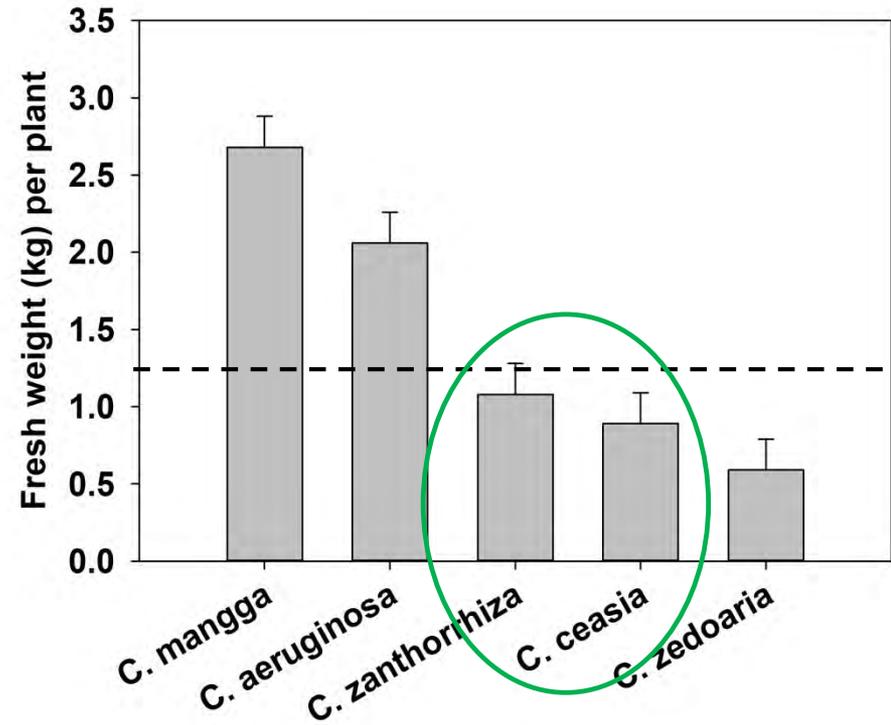
- Yields ranged between 0.75 – 2.0 kg of cleaned, marketable fingers per plant.
- Estimated @ ~ 16 - 43 t/ha.
- Reported commercial yield = 13 to 35 t/ha of fresh turmeric.
- Other attributes besides quality important.



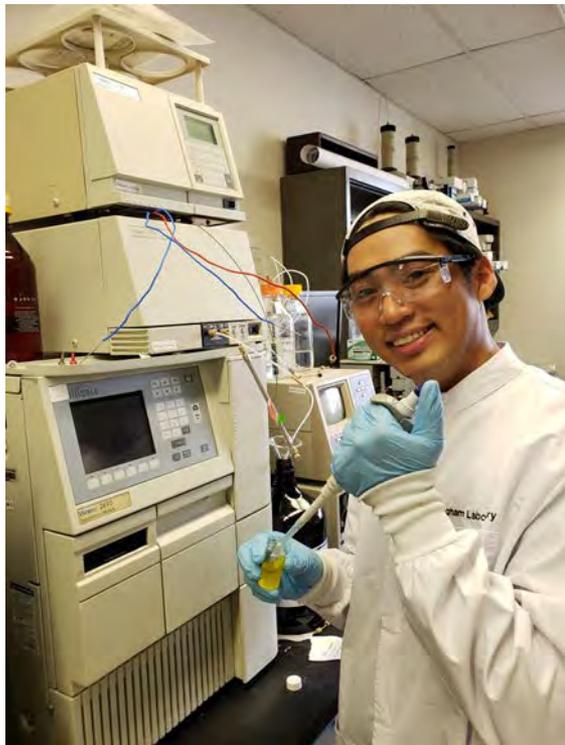
Yield of other species



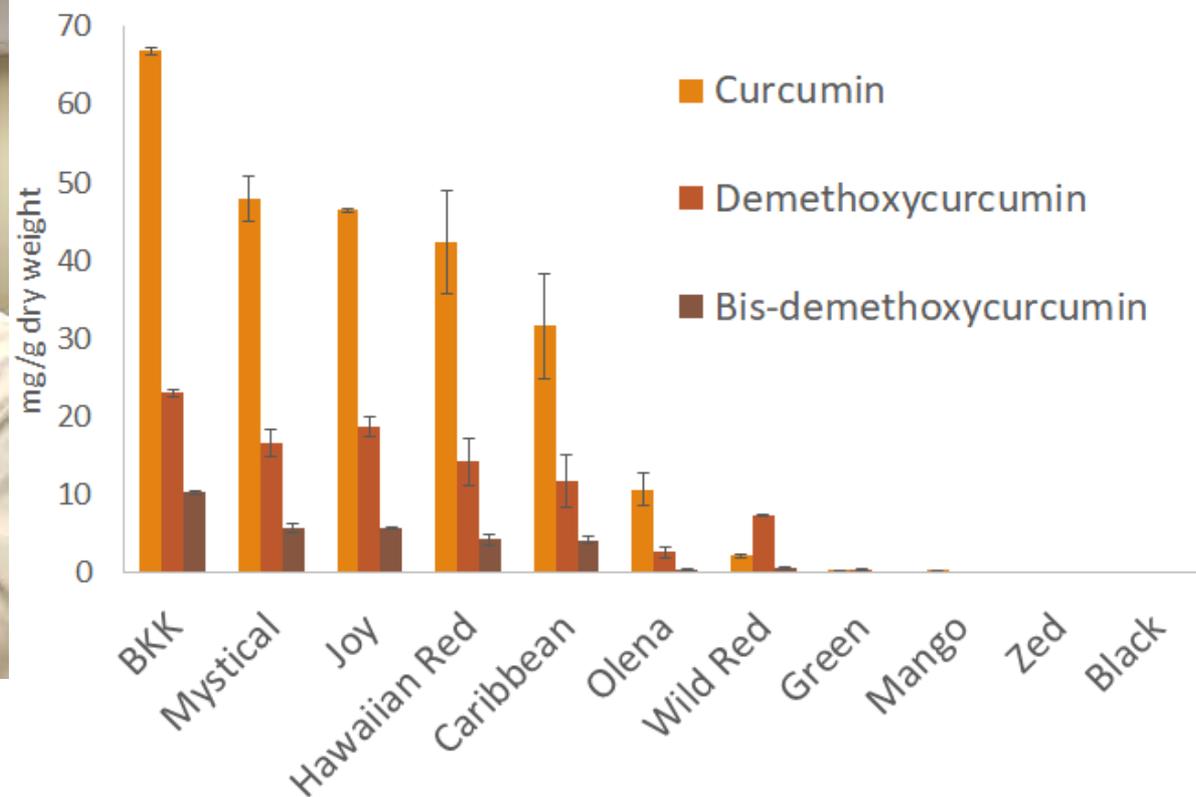
Yield of other species



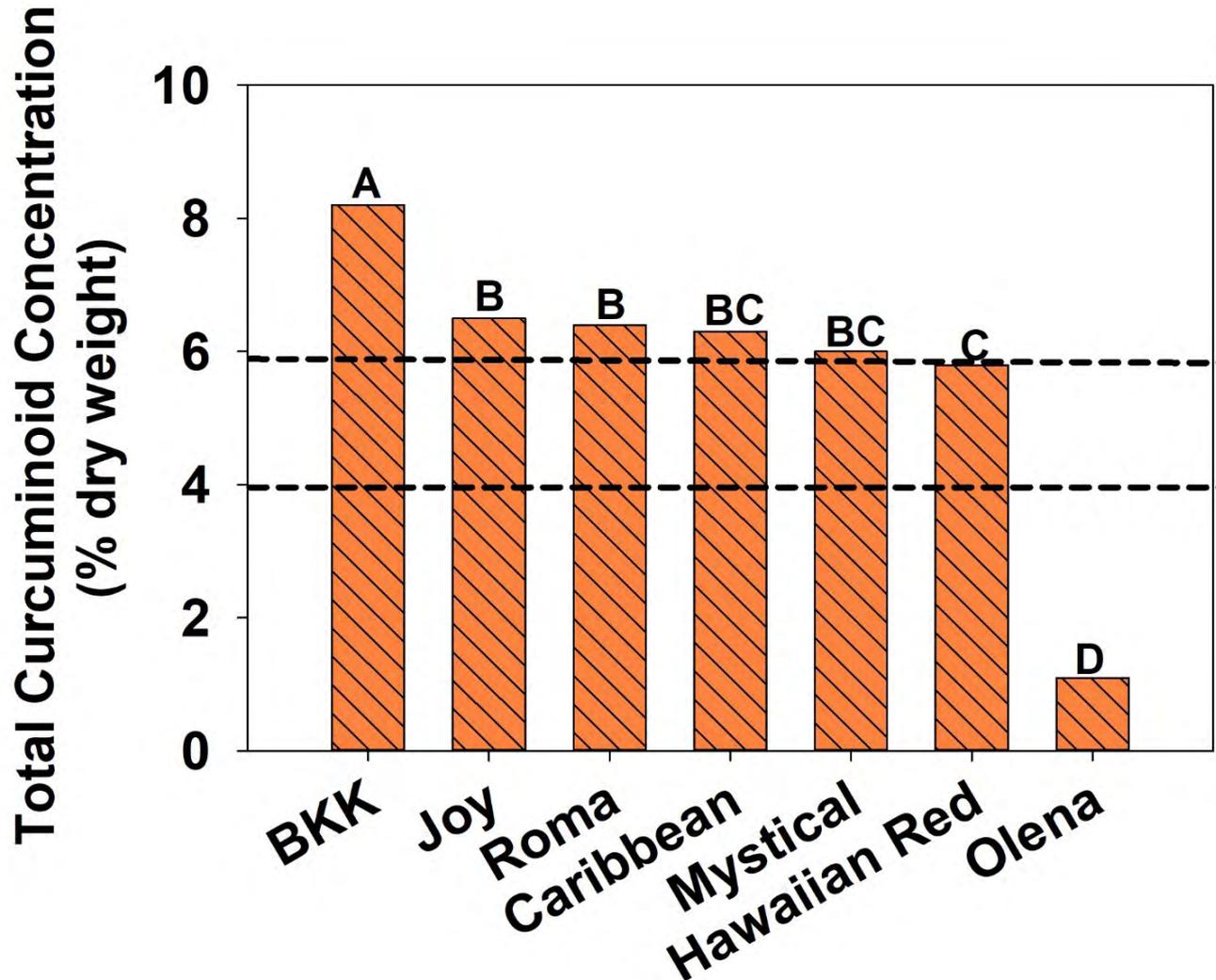
HPLC Analysis of Curcuminoids



Major Curcuminoid Content of 2018 Turmeric



Total Curcuminoid Content Waimanalo harvest 2019



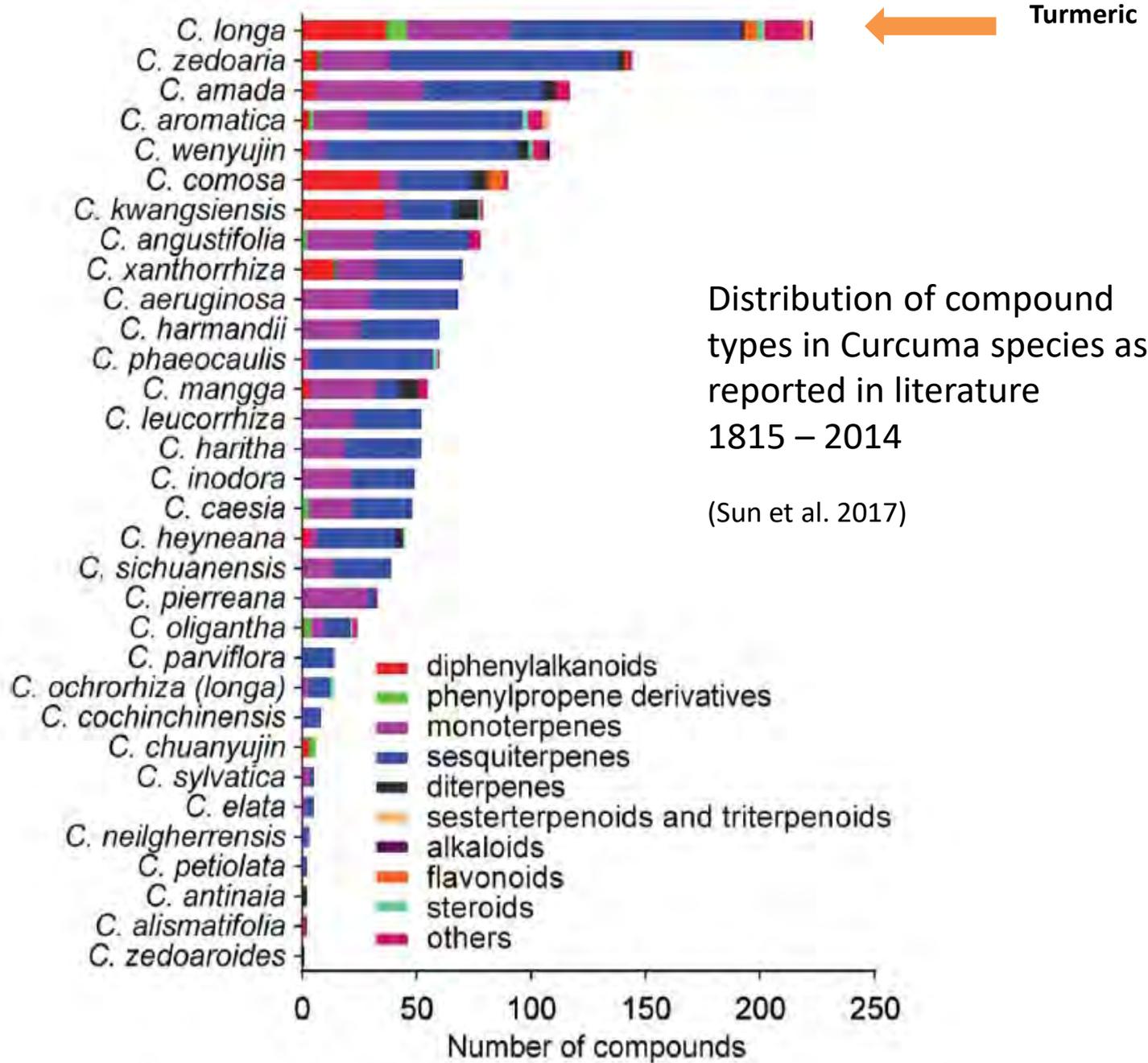
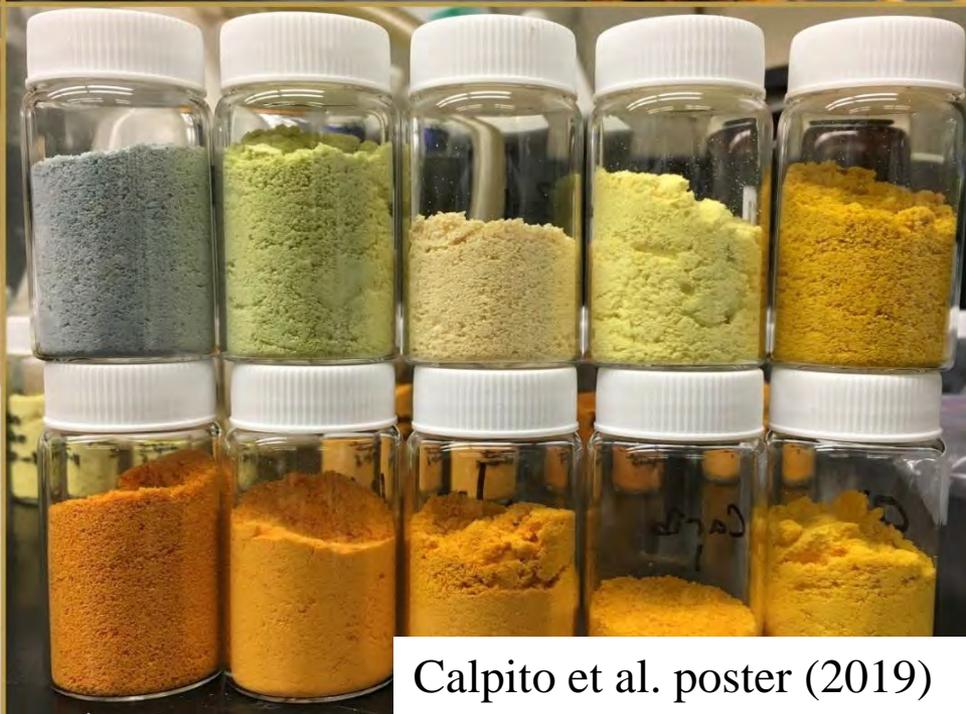


Figure 2. Distribution of various compound types in *Curcuma* species. Data were obtained from literature published in 1815–2014.

Kauai *Curcuma* Trials





Calpito et al. poster (2019)



Taste the rainbow!

Where to start?

- Tested 4 *Curcuma* species in 2017-2019:
 - *Curcuma longa*, 2 varieties
 - *Curcuma caesia*
 - *Curcuma mangga*
 - *Curcuma zedoaria*
 - *Boesenbergia rotunda* (fingerroot ginger)
- Added 4 more varieties of *C. longa* in 2019-2020





Curcuma longa - Turmeric



HI Red



BKK



Olena



Curcuma zedoaria – “White”





Curcuma caesia – “Black”





Curcuma manga – “Mango Ginger”





Boesenbergia rotunda– “Fingerroot Ginger”





Preliminary trial – 2017-2019





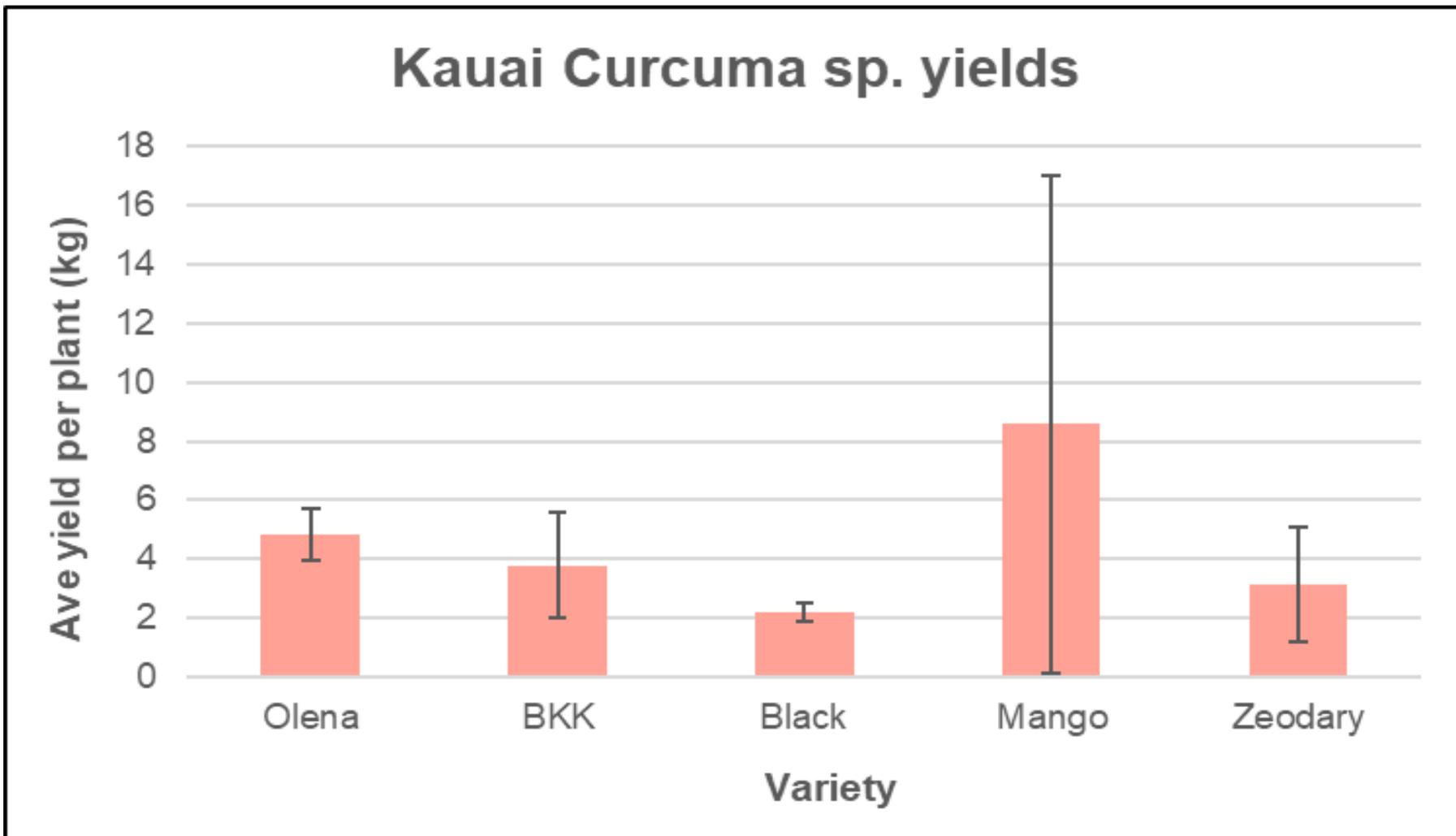
Preliminary trial – 2017-2019

- Planted Sept 2017
- Organic fertilizer: dry crumbles
- No irrigation
- Allowed to grow a second season
- Harvested April 2019





Preliminary trial – 2017-2019



Note: This yield data includes the mother corms



Kauai – 2019 trial





C. longa variety trial

- With irrigation this time!
- Sustane 8-2-4 applied at rate equal to 175 lb N/ac at planting
- Weeded by hand twice during the season
- Planted June 2019
Harvested Feb 2020



Curcuma longa - Turmeric



Harvest

The old-fashioned way...





Improved washing stations



Separating rhizomes from mother corms and starch roots

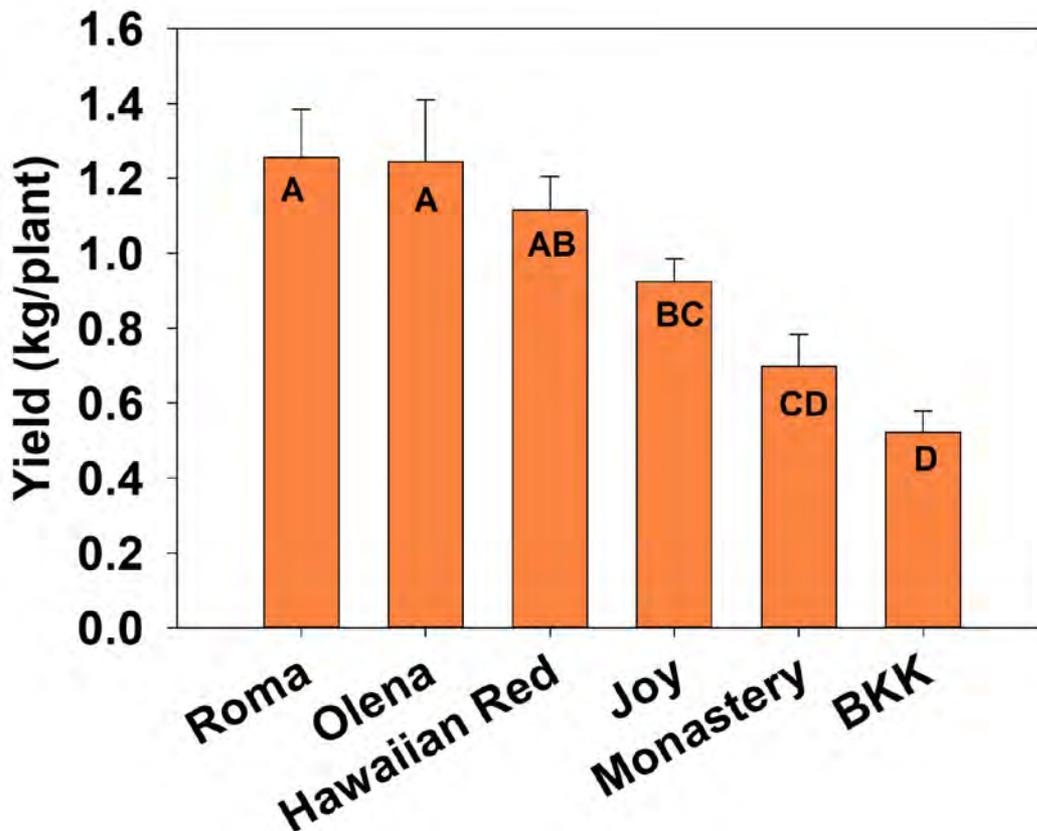






Kauai yield of *C. longa* – 2020 harvest

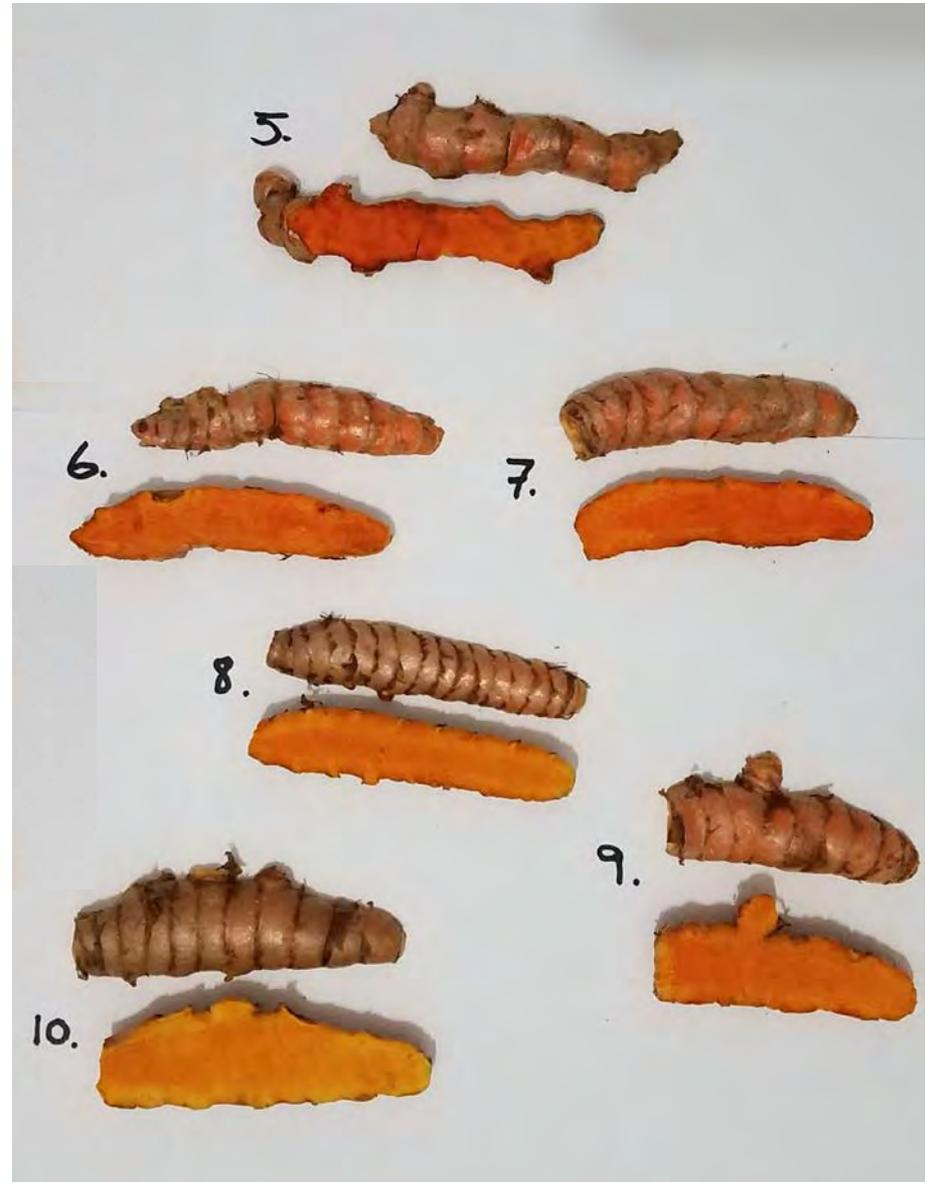
- Yields ranged between 0.38 – 1.66 kg of cleaned, marketable fingers per plant.
- Estimated @ ~ 8 - 35 t/ha.
- Reported commercial yield = 13 to 35 t/ha of fresh turmeric.



C. longa varieties

- Yields ranged between 0.38 – 1.66 kg of cleaned, marketable fingers per plant.
- Other important attributes?

5. BKK
6. Monastery
7. Hawaiian Red
8. Joy
9. Roma
10. 'Olena



Yield of other species

Species	Marketable yield (kg) per plant
Curcuma caesia “Black”	0.57
Curcuma mangga “Mango Ginger”	1.66
Curcuma zedoaria “White Zed”	0.48
Bosenbergia rotunda “Fingerroot Ginger”	0.23



#Turmerictrail2018

Singapore-India-Myanmar-Thailand

3 February – 5 March, 2018



Singapore Botanic Gardens



Singapore Botanic Gardens



Singapore Gardens by the Bay



Import Permits & Phytosanitary Certificates



India, Kerala





India, Erode (Tamil Nadu)



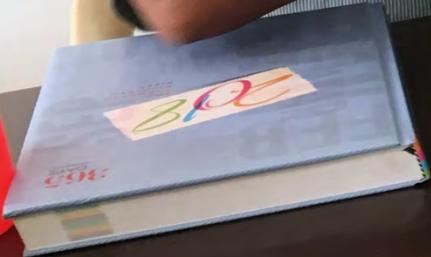






കാർഷിക മത്സ്യ വകുപ്പ്
മലപ്പുറം
Ph : 04204 200235

കാർഷിക



Sittilingi





Karnataka







Myanmar



Aquaponic Grow-Out



Aquaponic Grow-Out



Current field trial 2018-2019

- Mechanized planting
June 2018.
- Increased # of local *C. longa*.
- Fertilizer response trial using 'Hawaiian Red' (0, 100, 200, 400 lb N/a).
- Anticipated harvest
March 2019.
- Demonstrate
mechanical
planting/harvesting.



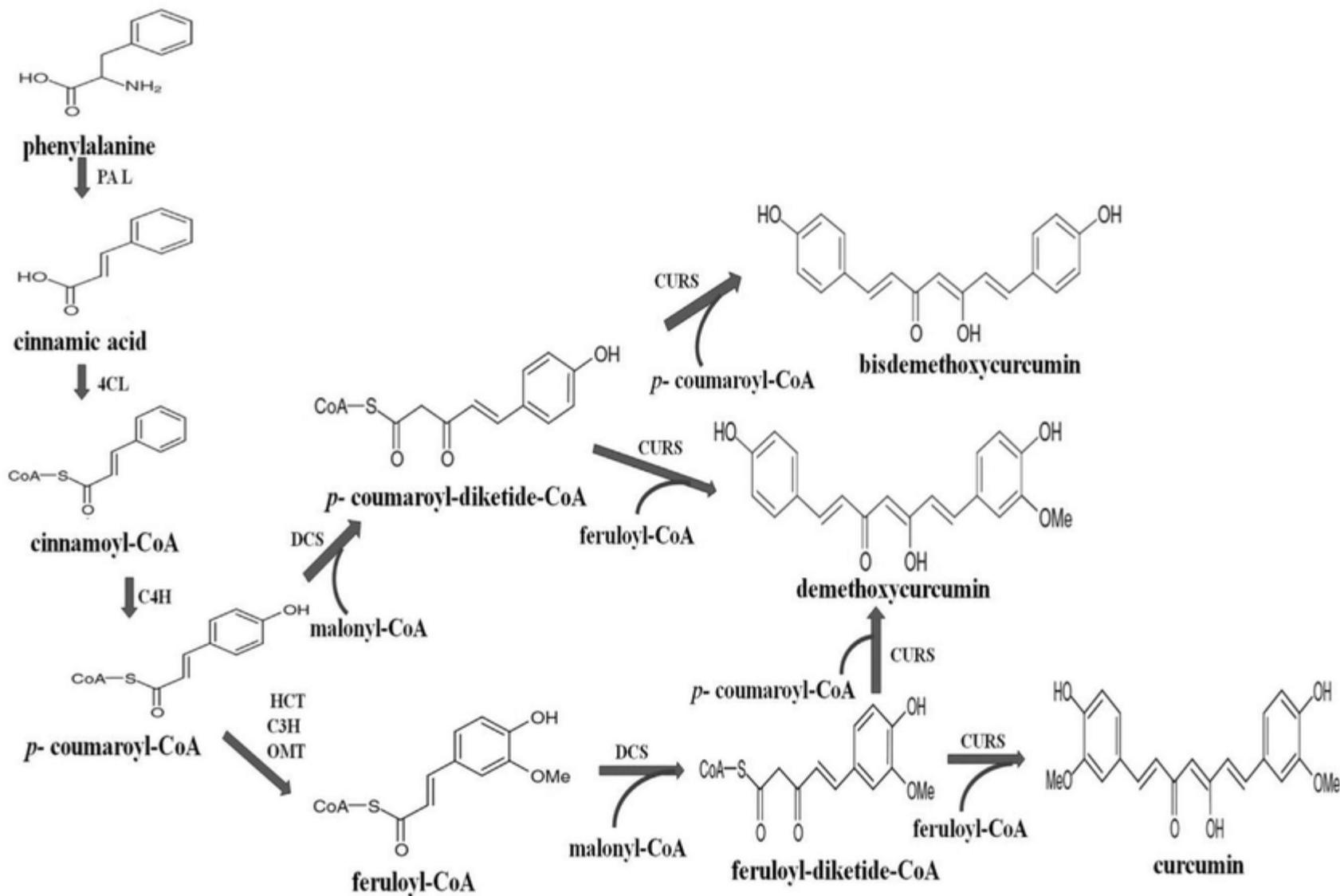


Mahalo



SeaSons
ORGANICS





1.



5.



2.



6.



7.



3.



8.



9.



4.



10.

