



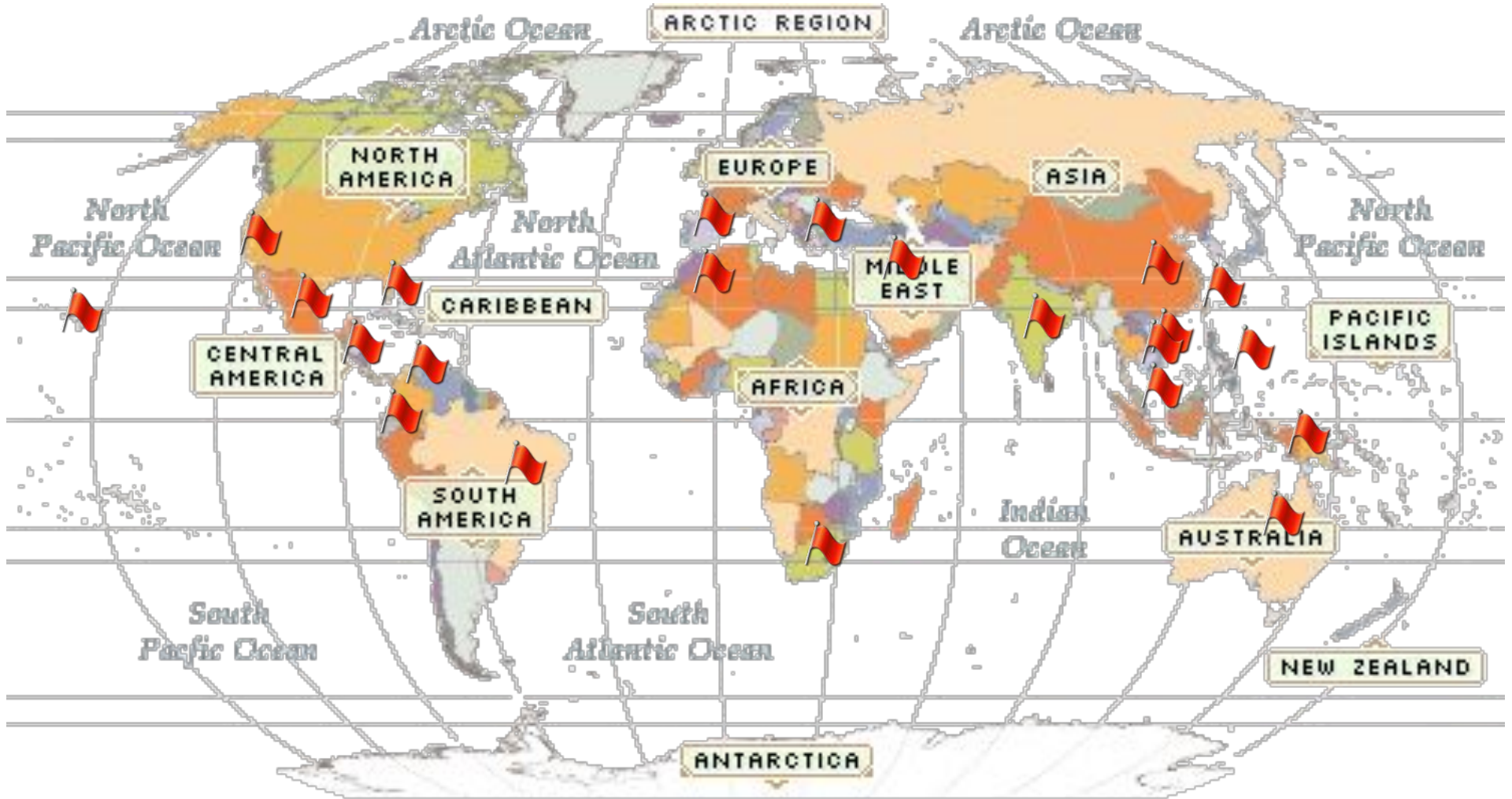
PITAHAYA PRODUCTION and MARKETING CONSIDERATIONS

2015 Specialty Crops Production Workshop

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UC Cooperative Extension, San Diego County

Pitahaya or Dragon Fruit Production



Map View: Robinson Projection

Why Pitahayas?

- Great potential as a new, water efficient crop for Southern California
- Increasing demand for new, healthy and exotic fruits
 - Current demand exceeds supply, current prices are high (retail @ \$ 3-8/pound)
 - Relatively high antioxidant activity when compared to other subtropical fruits
- Makes great landscape plant - fruiting cactus, water efficient, very adaptable

Fruit Uses

- Used in refreshments in Central America
- Red flesh used as colorant in the processed food industry (Snapples, Sobe, Pitaya+)
- Consumed fresh, as a desert item in the US, Canada, and Europe
 - Sliced in salads or cut in half and served chilled, with flesh eaten with spoon
- Used for decoration – Southeast Asia, US
- Great potential for value added products (ice cream, chips, chewy bars, wine, yarn dye, etc.)

U.S. Production

- US production is limited, but acreage increasing rapidly (1000-1200 acres)
 - California (400 - 500 acres.)
 - Florida (500 - 600 Acres)
 - Hawaii (100 - 200 Acres)
- Mostly white fleshed varieties used for fresh consumption or for décor/garnish
- Market is turning red...Pink/Red fleshed varieties becoming more popular
- Red fleshed varieties sell at higher price

Varieties Under Study

- Cebra (Nic)
- Rosa (Nic)
- Orejona (Nic)
- Lisa (Nic)
- Sin Espinas (Nic)
- San Ignacio (Nic)
- Mexicana (Mex)²
- Colombiana (SD/Col)³
- Valdivia Roja (Mex)
- Bien Hoa Red (SD)¹
- Bien Hoa White (SD)²
- Delight (SD)
- American Beauty (FL)¹
- Haley's Comet (FL)
- Physical Graffiti (FL)
- Vietnamese Giant (FL)²
- Yellow Dragon (FL/Col)³
- Seoul Kitchen (FL)
- Armando (Nic)*
- El Grullo (Mex)*

Pitahaya/Dragon Fruit Varieties



Pitahaya or Dragon Fruit Variety Evaluation Chart

(For Cold Hardiness & Heat Tolerance: 1 = low tolerance & 5 = High Tolerance)

Variety/Origin	Color Skin/Flesh	Cold Hardiness	Heat Tolerance	Avg. Wt. (grams)	Brix Score	Mkt Wt/Plant (grams)	Days to Harvest
1. Cebra (Nic.)	R/R	3.5	3.5	468	15.75	8746	46
2. Rosa (Nic.)	R/R	3.5	3.5	384	16.05	7217	45
3. Orejona (Nic.)	R/R	3.25	3.75	438	15.78	4598	45
4. Lisa (Nic.)	R/R	3.75	4	465	17.02	13319	44
5. Sin Espinas (Nic.)	P/R	2.25	2.75	393	16.5	3527	43
6. San Ignacio (Nic.)	R/R	3.75	4	552	15.6	12712	48
7. Mexicana (Mex.)	P/W	3.25	3	495	14.04	9165	40
8. Colombiana (SD-Col.)	Y/W	1	1	< 200	20.90	0	150-180
9. Valdivia Roja (Mex.)	R/R	5	4.5	250	17.9	8588	40
10. Bien Hoa Red (SD)	GR/F	1.75	1.75	360	18.9	1477	41
11. Bien Hoa White (SD)	P/W	2.5	2.5	388	11.85	7394	37
12. Delight (SD)	R/PW	3	3.5	371	18.08	14931	41
13. American Beauty (FL)	GR/F	2.75	2.5	380	18.51	5566	43
14. Haley's Comet (FL)	R/F	4.5	4.25	482	16.7	5979	38
15. Physical Graffiti (FL)	R/P	4.5	4.5	374	17.93	23429	40
16. Vietnamese Giant (FL)	PR/W	3.25	3.25	338	15.6	6511	41
17. Yellow Dragon (FL-Col.)	Y/W	1	1	< 200	21.15	0	150-180
18. Seoul Kitchen (FL)	PR/W	4	4	518	12.18	15379	41
19. Armando (Nic.)	R/R	4	4	390.5	16.11	4881	41
20. El Grullo (Mex.)*	R/R	4.5*	4.5*	489*	18.11*	U/K	40

SITE SELECTION

- In general, pitahayas grow well where Hass avocados grow
 - Frost free tropical/subtropical environment
 - Survive freezing temperatures for short periods
- They should be planted in full sun for optimal fruit production
- They adapt to various types of soils as long as drainage is not an issue
- They like soils high in organic matter

PROPAGATION

- Cuttings is most preferred method for commercial plantings
 - use mature wood
 - 12 to 18 inch cuttings are ideal if rooting them before planting, longer cuttings preferred if direct planting
 - May fruit after one year post transplant
- Seed germinates readily
 - great potential for breeding program
 - Slow grower, may take up to 6 years to fruit
- **Grafting is possible, but benefits not quite clear yet!**

PLANTING

- Spring/early summer planting preferred
- Direct planting may speed up establishment
- Must protect plant from rodents if present:
 - plant in a gopher or chicken wire basket or pots if gophers are a problem
 - Fencing may be needed if rabbits are present
- Protect young plants from the sun

SPACING & DENSITY

- Plant spacing depends on production system and trellis used
 - 6 by 10 feet spacing common with single post trellis (@ 726 plant/acre)
 - 4 by 6 observed in California & reported in Spain on bench-type trellis
 - 2 by 10 seen on commercial plantings, 3 by 8 or 3 * 10 used in our new field trials on wire trellis
- **Spacing & density depends on trellis system and plant structure desired!**

IRRIGATION/WATERING

- Minimal water for survival but they require more water for successful fruit production
- Successful production with 10 gal/plant/week
- Excessive watering in poorly drained soils can be disastrous
- Water stress may induce bloom, so you must cut back in water applied in the Spring
- Irrigation trial under way to fine tune water needs (0.25 to 1.5 avocado reference ET)

PRUNING

- Pruning depends on trellis/support system, variety, location, goals and desired plant structure
- Three basic strategies or goals for pruning:
 - Training: usually prune to encourage upright growth during first year
 - Sanitation: removal of dead or diseased stems
 - Thinning: to improve air circulation and exposure to sunlight

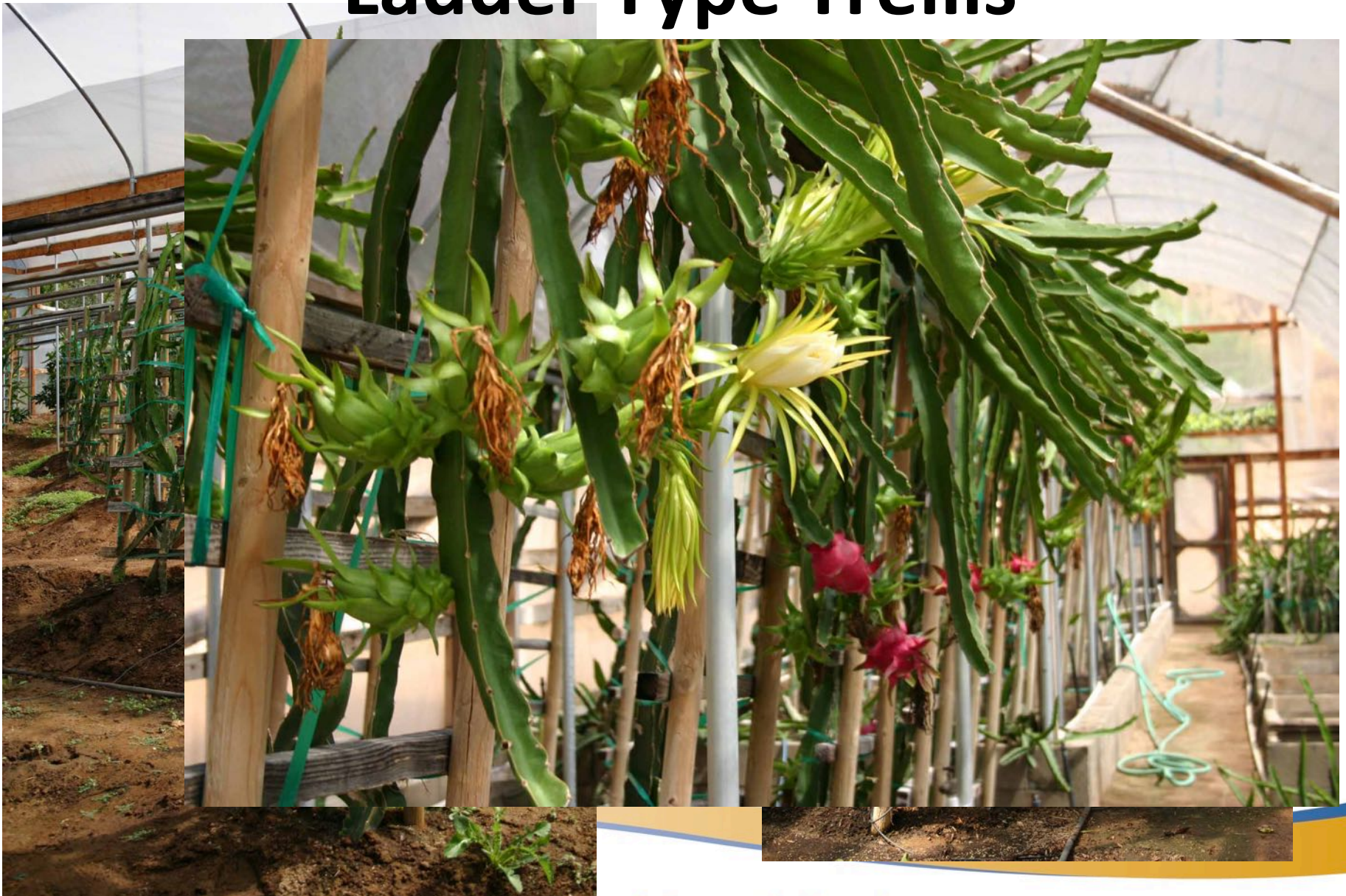
TRELLISING

- Pitahayas need trellis or support structures
- Type of trellis determined by desired plan structure, variety and location/topography
- Different types used in producing areas
 - Anything that can support a plant can be used
 - Live tutors used in Central America, but not an option for SD because of water cost
 - Concrete posts used in Southeast Asia
 - Combination of metal pipes and treated posts used in San Diego

Single Post (with or w/o “T”)



Ladder Type Trellis



Wire/Hedge Type Trellis

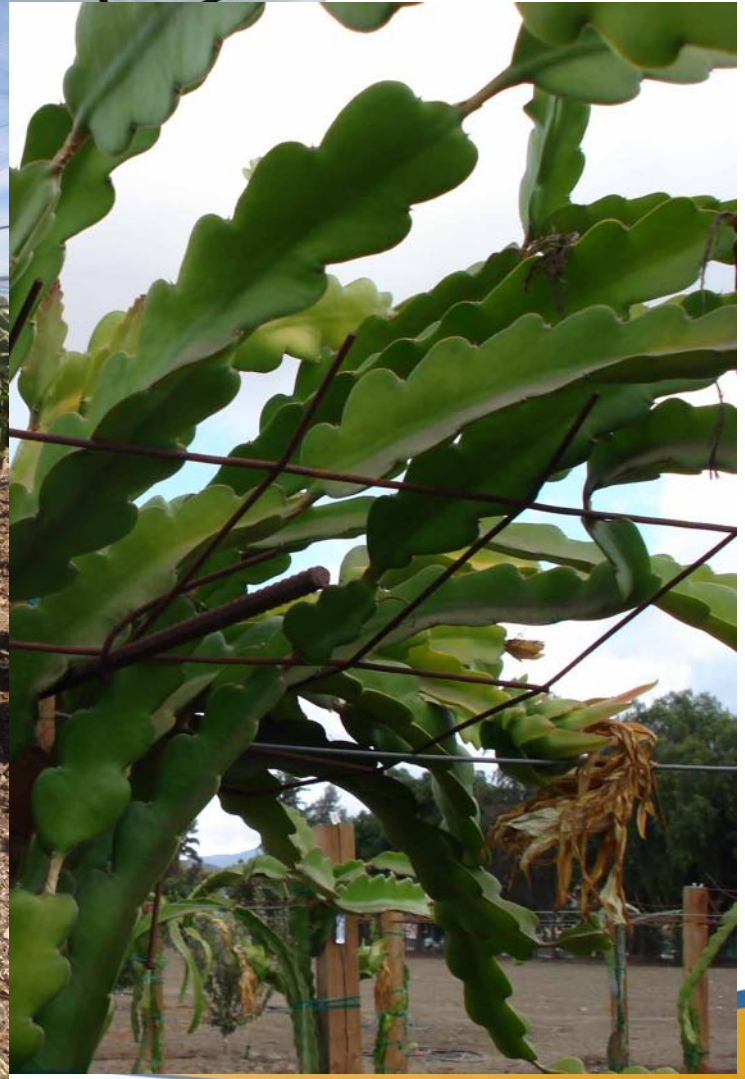


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SINGLE POST & WIRE TRELLIS



FERTILIZATION

- Fertilizer requirements of pitahaya not well understood yet.
 - 0.25 lbs/plant every 2 months in first year with gradual increases to 0.75 – 1 lb/plant of complete formula in year 4 is recommended in Florida. (Crane and Balerdi)
 - 100 lbs/acre/year active material or 4 oz/plant/quarter of 20-20-20, and 4 ounces of slow release triple 14 plus minor elements in the Spring
- Anecdotal information suggests pitahayas respond quite well to foliar fertilization

PEST/DISEASES

- **Gophers, squirrels, and rabbits** can feed on and kill plants and be significant problem.
- **Birds feed on fruits** - reduce marketable yield
- Cactus **scale** a problem in the greenhouse but not in the field
- **Ants, aphids and snails** can cause problems, damage young shoots and flower buds
- No major diseases/pathogens identified yet (disease like symptoms usually abiotic/physiological)
- Weeds can be a problem, increase prodn costs
- Cactus virus X isolated from samples

Gophers



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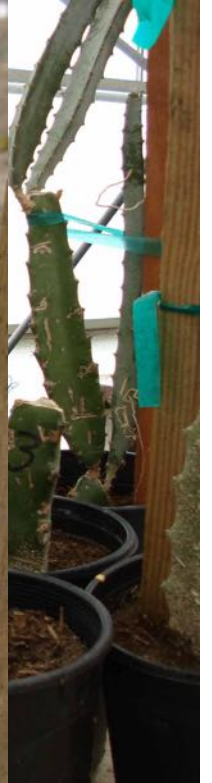
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Other Rodents



CACTUS SCALE



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APHIDS & ANTS



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WEEDS & MULCHING



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BIRDS



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BIRDS

- Most important economic pest of pitahayas in Southern California
- They cause significant market losses by direct feeding on mature fruits
- They splatter seeds on neighboring fruits while feeding, thus increasing packing and marketing costs
- They perch on plants which may represent a food safety risk
- Netting or other mgt practice is a **MUST!!**

Cactus Virus X (CVX)

- Effect on plants not fully known
- No known vector, mechanically transmitted
- Potential external symptoms of CVX on various cacti include:
 - Chlorotic circles, mottling on the stems
 - Rings and spots on pads (*Opuntia* spp.) or on the shoots (*Hylocereus* spp.)
 - Reddening of fronds on Christmas cactus (*Zygocactus* sp.)
 - Occasional Extreme symptoms like bending, yellowing and die back of stems may also occur.

M. Chessin. "Symptoms of Virus Infection in Cactus."
ISHS Acta Horticulturae 568: X International Symposium
on Virus Diseases of Ornamental Plants

What to do @ CVX

- Increase phytosanitary measures:
 - Use only clean, virus free plant material
 - Keep your plants and your fields clean
 - Dispose plant litter after pruning
- Sanitize your tools:
 - Alcohol dips (ethanol or isopropyl alcohol)
 - Alcohols dips + flaming (standard for tissue culture)
 - Chlorine treatment (Chlorox, monochloramine)
 - Household cleaners (Listerine, Lysol, Pine-Sol)
 - Trisodium Phosphate (Na_3PO_4 ; 10 % solution)

Chalker-Scott, L. "Sterilized Pruning Tools: Nuisance or Necessity?"
WSU Puyallup Research and Extension Center

FLOWERING/FRUITING



FLOWERING

- Flowering usually starts in the Spring, in late April and intensifies in June
 - Flowering can be induced with water stress
- It takes an about 20-21 days from bud break to bloom, and about 40 days from bloom to harvest
- Flowers bloom at night and remain viable for one night only

POLLINATION

- Night blooming cactus, large flowers, some with strong scent
- Pollinized by moths and bats in Central America; mostly bees in Southern CA.
- Research emphasis on on self fruitful or self pollinating clones
- Hand and cross pollination improves fruit set and fruit size considerably
- **Most important issue with Dragon Fruit...self-fertility, self-pollination, self-sterility, self-compatibility**

POLLINATION

- Hylocereus pollen can be stored for long periods of time in a household freezer if moisture content reduced to within 5-10 %
- Temperatures below 0 Celsius should be used for long term storage
- Pollen storage can help ensure yields in commercial orchards
- Critical for breeding efforts because crossing could be made regardless of the flowering period

Metz, et. al. 2000



UCSF San Diego



UCSF San Diego

Seasonality of Pitahaya Cultivar in Southern California

Variety	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Cebra				XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Rosa				XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Orejona				XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Lisa				XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Sin Espinas			XX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX		
San Ignacio				XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Mexicana					XXX	XXXXXX	XXXXXX	XXX				
Colombiana									XXX	XXXXXX	XXXXXX	XX
Valdivia Roja				XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Bien Hoa Red				XXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XX		
Bien Hoa White					XXX	XXXXXX	XXXXXX	XXX				
Delight			XX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX			
American Beauty				XXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX			
Halley's Comet					XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX		
Physical Grafitti					XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX		
Vietnamese Giant					XXX	XXXXXX	XXXXXX	XXX				
Yellow Dragon									XXX	XXXXXX	XXXXXX	XX
Seoul Kitchen				XXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
Armando					XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	
El Grullo					XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX	

HARVEST/HANDLING

- It takes an average of 40 days for the fruit to develop and mature
- Proper handling is critical to preserve fruit quality and external appeal
- Must pay attention to variety differences when picking & storing
- Fruit stored at 10-12 C and 85-90 % HR has a shelf life of 2-3 weeks (Cantwell)

PACKING/MARKETING

- Few handlers/packers available in SoCal, may have to pack on your own
- Fruit commercially packed in 6, 10, and 20 lb. boxes
- Market preference for red/colored flesh varieties, over \$ 1.00 more per pound
- Most imports from Vietnam, Nicaragua, Florida and California appear on Reports
- Quality, flavor, local...our selling points!

PACKING/MARKETING



Pitahaya Market & Price Info

- USDA-AMS Market Report calls everything “Red Pitaya” but refers to skin color, no indication about flesh color.
- www.usda.ams
 - Market News
 - Fruit Vegetables and Specialty Crops
 - Market News Portal – Fruits and Vegetables
 - Fruits
 - Dragon Fruit (Red Pitaya)
 - From here you can refine the report by market, date, etc.

Packaging and Marketing

Date	Market	Origin	Color	Pack	Type	Price US \$
8/18/14	Los Angeles	Nicaragua	Red	10 lbs.	Conventional	32.00 – 33.00
8/18/14	Los Angeles	Vietnam	Red	10 lbs.	Conventional	23.50 – 29.00
8/18/14	Los Angeles	California	Red	10 lbs.	Organic	57.50 – 57.50
8/18/14	Los Angeles	California	Red	6 lbs.	Organic	42.85 – 42.85
8/18/14	San Fran	Nicaragua	Red	10 lbs.	Conventional	38.00 – 38.00
8/18/14	San Fran	Florida	Red	20 lbs.	Conventional	50.00 – 50.00
8/18/14	San Fran	Florida	Red	¾ B.C.	Conventional	60.00 – 65.00

Source: USDA/AMS Website

Packaging and Marketing

Date	Market	Origin	Color	Pack	Type	Price US \$
8/21/14	Los Angeles	Nicaragua	Red	10 lbs.	Conventional	32.00 – 33.00
8/21/14	Los Angeles	Vietnam	Red	10 lbs.	Conventional	30.00 – 35.00
8/21/14	Los Angeles	California	Red	10 lbs.	Organic	57.50 – 57.50
8/21/14	Los Angeles	California	Red	20 lbs.	Conventional	56.00 – 60.00
8/21/14	Los Angeles	California	Red	6 lbs.	Conventional	42.00 – 42.00
8/21/14	Los Angeles	California	Red	6 lbs.	Organic	42.00 – 42.00
8/21/14	San Fran	Nicaragua	Red	10 lbs.	Conventional	38.00 – 38.00
8/21/14	San Fran	Florida	Red	20 lbs.	Conventional	50.00 – 50.00
8/21/14	San Fran	Florida	Red	¾ B.C.	Conventional	60.00 – 60.00

Source: USDA/AMS Website

Economic Prospects

- Great potential as a commercial crop
- Establishment costs can be high, ranging from \$15000-25000/per acre
- Value per acre can be significant if yield and quality are maximized (> 20,000 lbs/acre)
- Downward pressure on price will continue because of increased domestic production and import volume (\$1.50 to \$3.00/lb. farm gate prices; \$6-8 at CFMs)
- Red fleshed varieties usually sell at a higher price than white fleshed varieties (~ \$1.00/lb)
- Risky Business...BE CAUTIOUS!!

Marketing Pitahaya or Dragon Fruit: 10 Things a Distributor Wants (Frieda's Handout)

Understand your customer's business	Labeling and Trace Back
Participate in Marketing	Food Safety and Insurance
Don't be Greedy	Quality Control
Target Dates and Yield Estimates	Pack Size & Pricing
Post-Harvest Control	Variety & Flavor

Success in agriculture depends on marketing what you grow at a profit. Do your homework, develop a business/marketing/food safety plan and spend time talking to prospective buyers or consumers!!

The End...Questions??

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