



Kiwifruit Production in SE U.S.

Jay Spiers

Background

- Genus *Actinidia* contains 66 species (Actinidiaceae)
- Large woody vines from Eastern Asia
- Two most economically important species:
 - *A. deliciosa*: green fruit with fuzz
 - *A. chinensis*: gold fruit with little to no fuzz
- Dioecious (separate male & female) plants
- Fruit is botanically a berry with many small, edible seeds



History and Development



- ❖ Subsistence production in China for thousands of years
- ❖ First brought to New Zealand in 1904
- ❖ First commercial orchard in 1934
- ❖ Named changed to “kiwifruit” after national bird of NZ in 1959
- ❖ First commercial planting in Central California in 1967
- ❖ Golden kiwifruit introduced to New Zealand in 1991
- ❖ Marketed as novelty and for high Vitamin C (twice that of orange)

Economics

- ❖ 2013 world production 3.26 Million tons (20th among fruits)
- ❖ ≈600% increase in production over past 20 years
- ❖ Top producers: China, Italy, and New Zealand
- ❖ United States ranks 10th (2% of world production) (FAO)
- ❖ California produces 98% of all U.S. kiwifruit
 - ❖ Other states: AL, NC, OR, SC
- ❖ Golden kiwifruit production very limited, but increasing

Production

- Production range limited by lack of cold tolerance (-12°)
- Well-drained soils, pH 5.5 to 7.0
- Vines are easily damaged by wind
- High input: 1,000 - 1,200 mm water; 170 kg N per hectare
- Vigorous vines require extensive trellising
- Major diseases include *Phytophthora* & *Pseudomonas* (P.S.A)
- Yield can reach 25 tons per acre
- Fruit are climacteric, store 3-6 months
- Environmental effects on anthocyanins; Vitamin C degradation



Lots of genetic material in *Actinidia* genus

- ❖ *Actinidia*: 66 species and 118 taxa, in the world
- ❖ Sixty-two species in China
- ❖ Most species: edible fruits
- ❖ Two main species and two minor species are in commercial production: *A. deliciosa*, *A. chinensis*

A. eriantha, *A. arguta*



A. deliciosa



A. chinensis



A. eriantha



A. arguta

Other Species with Horticultural and Commercial Significance



A. macrosperma

A. rufa



A. arguta var. *purpurea*



A. kolomikta



A. valvata

A. latifolia



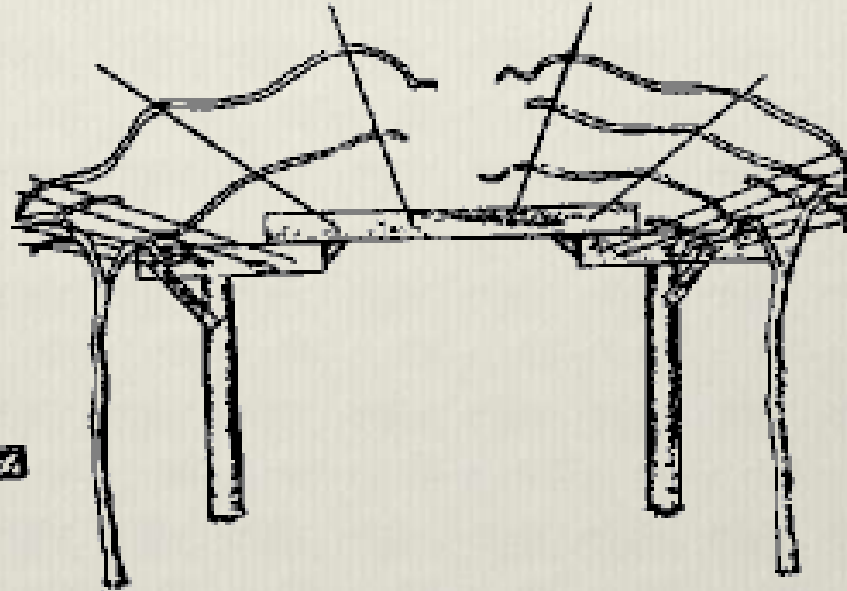
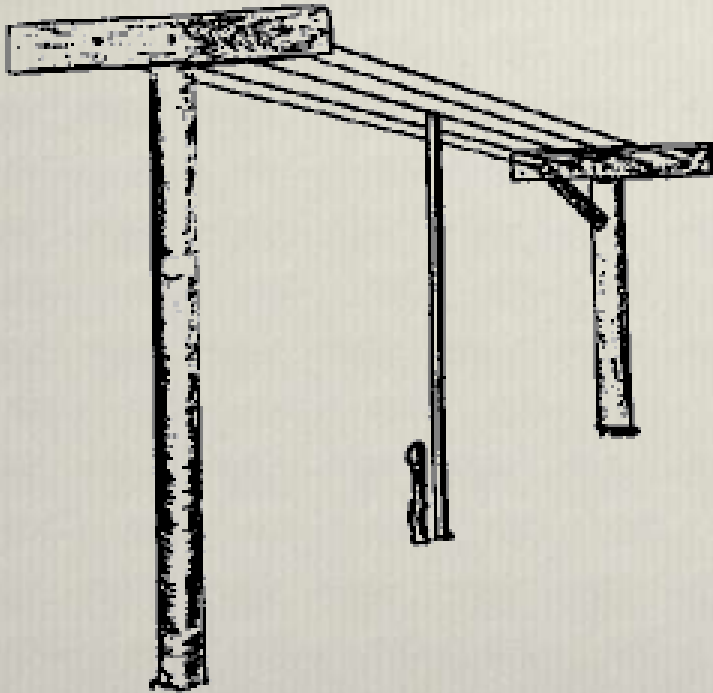
A. chinensis var. *rufopulpa*

Trellis Systems

❖ Pergola

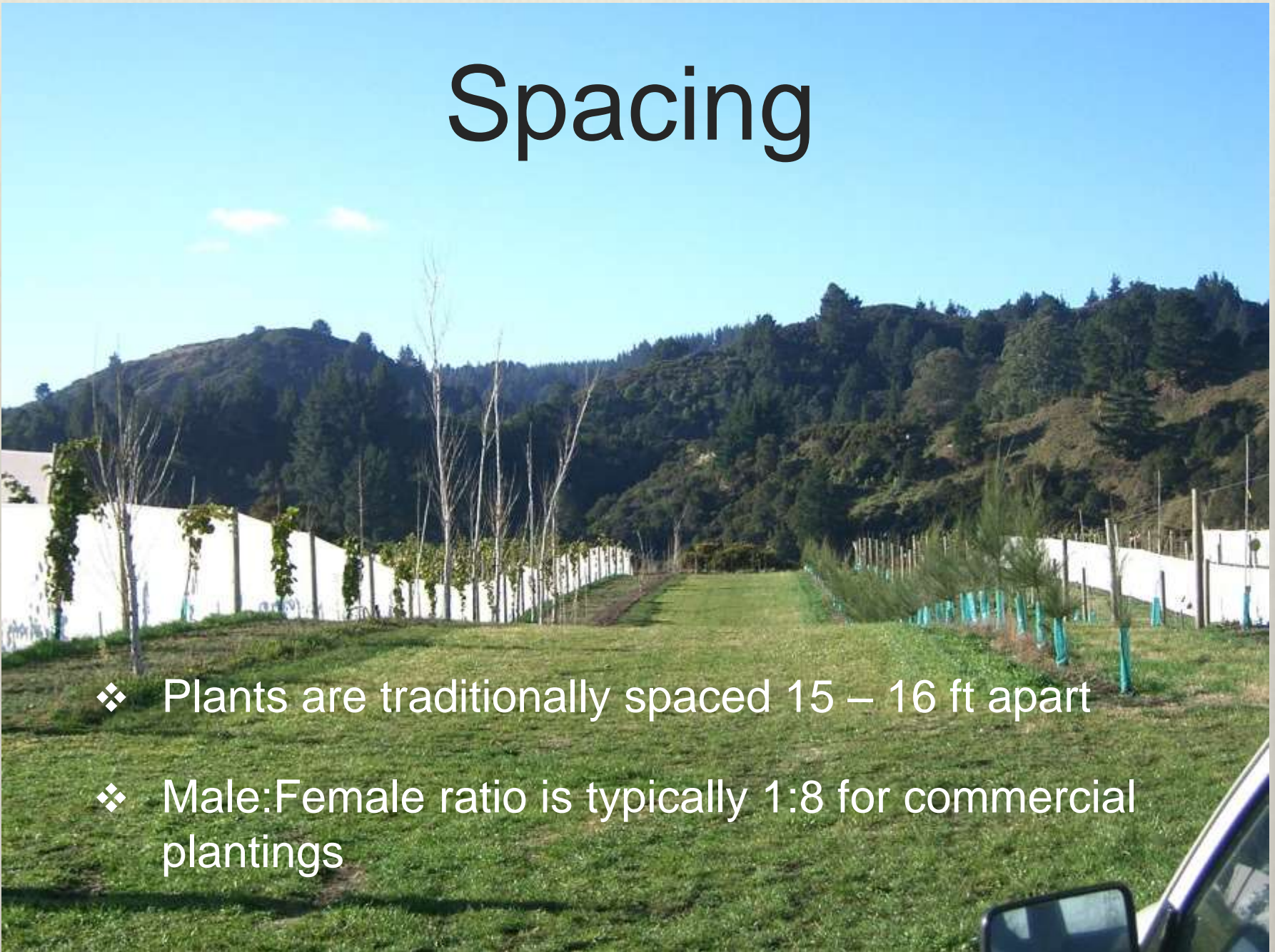


❖ T-Bar



Spacing

- ❖ Plants are traditionally spaced 15 – 16 ft apart
- ❖ Male:Female ratio is typically 1:8 for commercial plantings



Replacement canes

- ❖ In New Zealand, replacement canes are grown up strings above trellis to be more easily laid down



Gold Pruning



- ❖ Cut off old fruiting canes
- ❖ Lay replacement canes down from above
 - ❖ Ideally, coming from main cordon and space 10-12" apart

Male Pruning

- ❖ Male plants are pruned similar to muscadines
- ❖ Spur pruning

Winter Pruning



Pollination Issues

- ❖ Flowers have no or low nectar
- ❖ Bees have to be placed in orchard at 2-3 hives per acre
- ❖ Competition flowering
- ❖ Artificial methods



Dry pollen applications





Wet pollen applications (with 'PollenAid')



Actinidia deliciosa



AU Fitzgerald

Actinidia chinensis



'Golden Dragon' and 'Golden Sunshine'

- ❖ Developed by researchers at the Institute of Fruit and Tea, Academy of Agriculture Sciences, Hubei Province, P.R. China.
- ❖ Golden Dragon ('Jinnong') and Golden Sunshine ('Jinyang') both bred from seedlings of wild *Actinidia chinensis* in the early 1980's.
- ❖ Trials began in central Alabama in mid-1990's.
- ❖ Agreement signed between Institute of Fruit and Tea and Auburn University on Oct. 10, 2008 for joint release and patent application.



'AU Golden Dragon'



'AU Golden Sunshine'

AU Golden Dragon



Golden Dragon
9/16/09



AU Golden Sunshine





Golden Dragon

9/3/09



Golden Sunshine

9/3/09



Hort 16A

9/3/09

'AU Gulf Coast Gold'

- ❖ 'AU Gulf Coast Gold (patent-pending) is the result of a bud mutation that occurred on an 'AU Golden Sunshine' plant research trial in south Alabama.



AU Gulf Coast Gold





Kiwi Biology

- ❖ Dioecious fruiting vine with separate plants producing either male or functionally female flowers



Male flower

Female flower

Bloom period of gold kiwifruit cultivars and male pollinizers for 2009 and 2010 seasons

Cultivar	Year	Bud swell	50% bloom	Full bloom	Petal fall
'AU Golden Dragon'	2009	March 30 – April 1	April 3 – 6	April 8 – 13	April 13 – 17
	2010	April 9	April 14	April 16	April 16 – 19
'Hort16A'	2009	April 1 – 3	April 8 – 10	April 10 – 13	April 13 – 17
	2010	April 12	April 16	April 19	April 21
Hortkiwi 'Meteor'	2009	March 30 – April 1	April 3 – 8	April 10 - 13	April 17 – 20
	2010	April 9	April 14 - 16	April 16 - 19	April 19 – 23
'AU Golden Sunshine'	2009	April 17 – 20	April 24 – 27	April 27 – 29	April 29 – May 1
	2010	April 21 – 23	April 23 – 26	April 26 – 30	April 30 – May 3
'AU Gulf Coast Gold'	2009	April 16 – 20	April 24	April 24 – 28	April 28 – May 1
	2010	April 19 – 21	April 23	April 26 – 28	April 30 – May 3
'AU Golden Tiger'	2009	April 20 – 24	April 27 – 29	April 29 – May 1	May 1 – 5
	2010	April 23 – 26	April 28 – 30	April 30 – May 3	May 5

CK-3 'Meteor' (Male)



AU Tiger (Male)



Harvest date and fruit quality of gold kiwi cultivars

Cultivar	Harvest date	Weight (g)	Firmness (kg)	Soluble solids (%)	Dry matter (%)	Flesh color (hue°)
	2014					
'AU Golden Dragon'	Aug. 28	97.5 ± 7.8	5.8 ± 0.7	7.2 ± 1.0	17.1 ± 0.007	102.3 ± 2.6
'AU Golden Sunshine'	Sept. 4	100.4 ± 7.0	6.8 ± 1.9	9.2 ± 3.0	18.7 ± 0.012	103.0 ± 2.0
'AU Gulf Coast Gold'	Oct. 2	103.2 ± 14.3	5.2 ± 0.4	8.9 ± 0.4	21.1 ± 0.006	100.5 ± 2.1
'Hort16A'	Oct. 16	82.4 ± 14.9	5.2 ± 0.7	12.7 ± 1.6	22.1 ± 0.014	102.1 ± 3.2
	2015					
'AU Golden Dragon'	Aug. 25	103.9 ± 7.2	4.0 ± 0.5	7.0 ± 0.6	16.8 ± 0.008	100.1 ± 2.7
'AU Golden Sunshine'	Aug. 31	110.5 ± 12.0	4.1 ± 0.4	8.5 ± 1.0	18.1 ± 0.010	98.7 ± 2.5
'AU Gulf Coast Gold'	Sept. 21	88.9 ± 8.9	4.0 ± 0.5	8.8 ± 0.7	21.2 ± 0.008	102.0 ± 2.9
'Hort16A'	Oct. 19	90.5 ± 9.6	5.6 ± 1.0	15.1 ± 1.0	22.2 ± 0.007	103.0 ± 2.5
	2016					
'AU Golden Dragon'	Aug. 15	116.6 ± 8.3	5.3 ± 0.5	7.3 ± 0.9	16.6 ± 0.007	100.7 ± 1.4
'AU Golden Sunshine'	Aug. 29	109.7 ± 12.0	3.9 ± 1.4	10.1 ± 1.9	17.1 ± 0.003	101.6 ± 2.7
'AU Gulf Coast Gold'	Sept. 27	82.9 ± 13.0	5.6 ± 1.5	12.6 ± 2.1	20.9 ± 0.008	101.9 ± 2.9
'Hort16A'	Oct. 4	71.3 ± 7.4	5.6 ± 0.9	13.3 ± 1.9	22.6 ± 0.006	101.8 ± 3.3

Future Kiwifruit Research

❖ AU Variety Trials

- ❖ Fairhope, AL
- ❖ Brewton, AL
- ❖ South MS, Stone Co. – USDA
- ❖ Nacogdoches, TX – Stephen F. Austin U.
- ❖ Virginia Beach, VA – Virginia Tech

❖ Pollination Research

❖ Increasing fruit size

- ❖ Flower thinning vs fruit thinning
- ❖ PGRs

❖ Rootstocks



Southeast Kiwi Farming Cooperative, Reeltown, AL





Green Rootstock







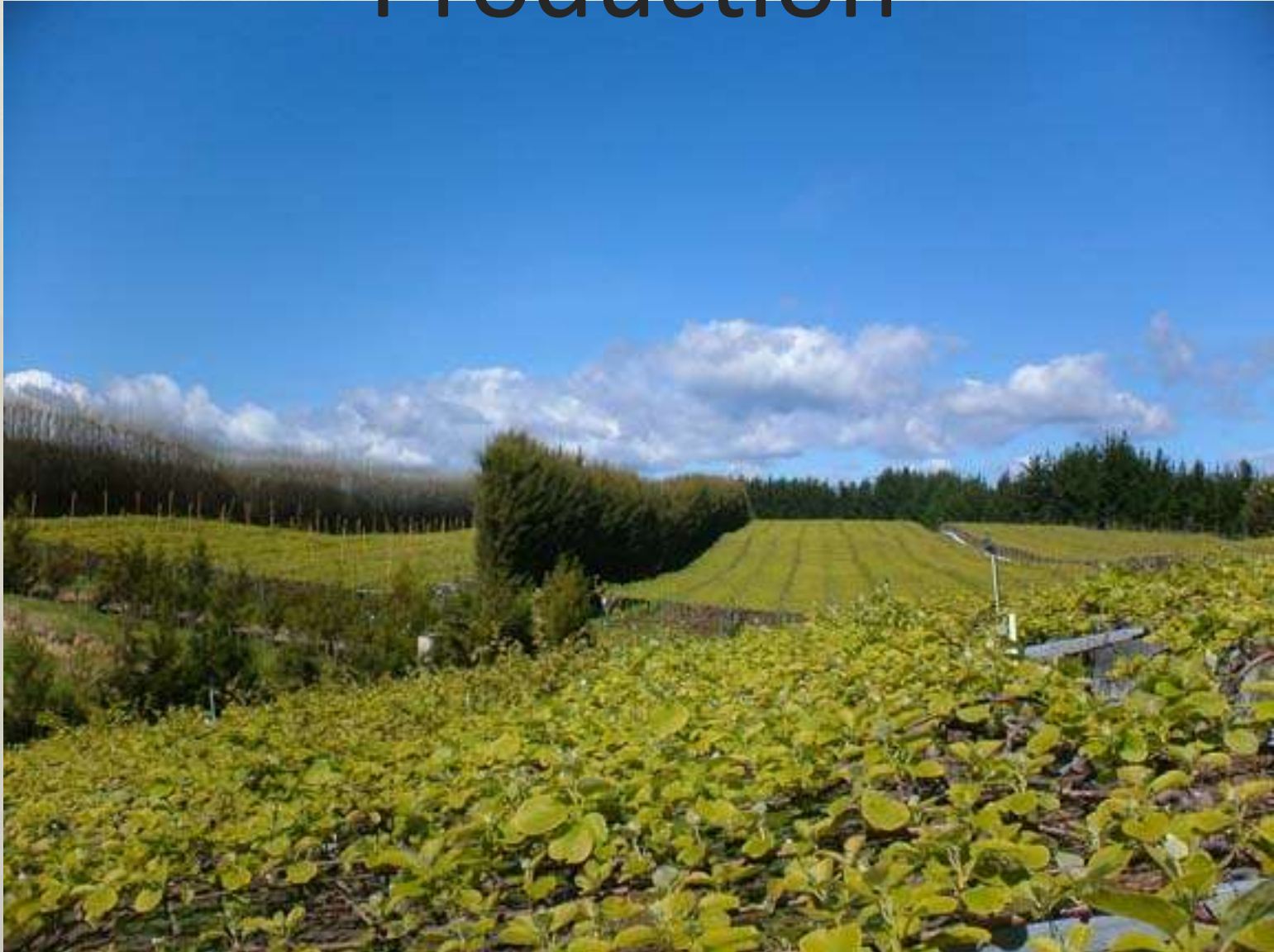








New Zealand Kiwifruit Production

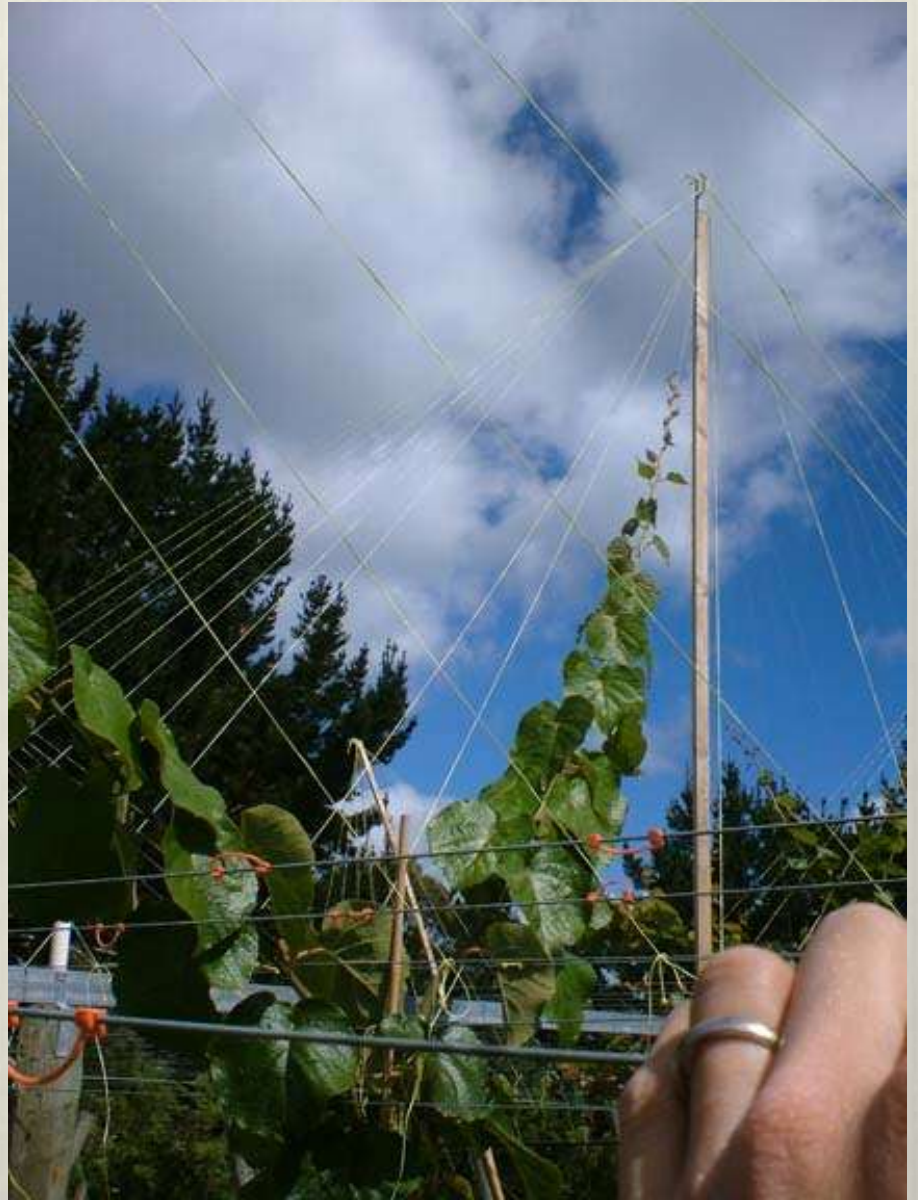


Post placed on male row
~10 ft above canopy













Spring time













“Asparagus”
tip





“Notch” graft to avoid losing yr of production



Use cleft
graft after
notch is
made with
chainsaw



Harvest









Replacement Canes



Strings tied about 10-12
in. apart



California kiwifruit production

Only green (*A. deliciosa*)



Pergola







T-bar



It is anticipated that these 3 new cultivars will perform well for home and commercial production in SE U.S., and allow for a lengthy harvest period.

Approximate Harvest Periods

AU Golden
Dragon

Aug. 25-Sept.1

Oct

AU Golden
Sunshine

Sept. 1-7

AU Fitzgerald

mid-late

