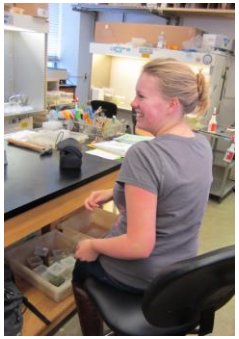
Development of New Walnut Varieties and Rootstocks

Reid Robinson

Chuck Leslie
UC Walnut Improvement program



Morgan McMahon

Farm Advisors,
USDA, Nurseries, Growers

USDA

UC CE University of California Cooperative Extension

UCDAVIS
DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences

CALIFORNIA Walnuts

New Scion Varieties

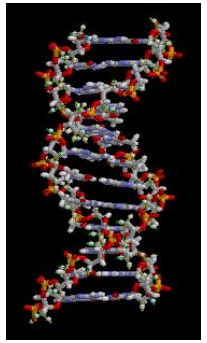
Goals:

- Early Harvest Date
- Light Kernel Color
- Low Blight
- High yield
- High percent kernel
- Ease of kernel halves
- Precocity
- Laterally fruitful
- Nut size
- Low PFA
- In-shell traits

Breeding Process

Seedling Evaluation

Use of Genomics



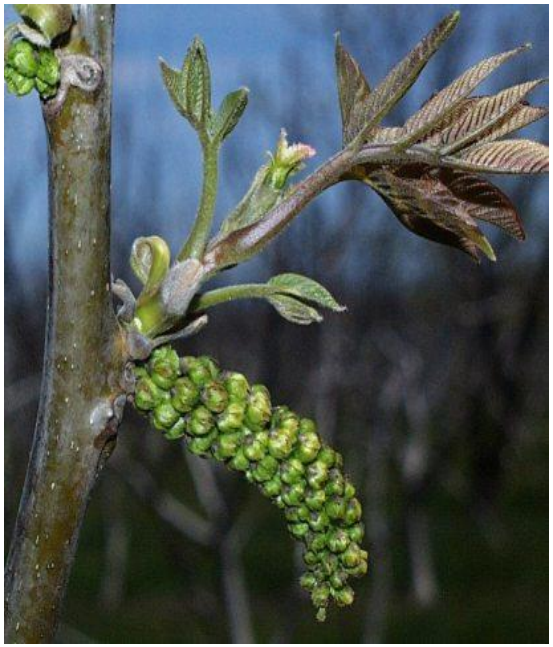
- DNA markers for traits of interest
- Selection based on DNA prior to field planting
- Using this year to select lateral vs. terminal bearing seedlings

Grower Trials

Walnut Crackout Meeting

Forde

61-25 x Chico



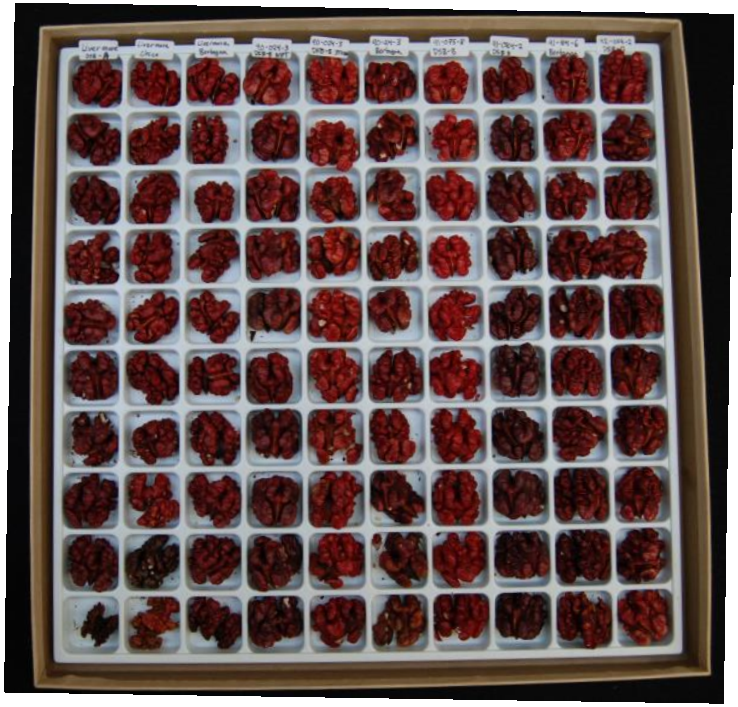
- **Leafs – a week or more after Payne**
- **Harvests – with Chandler**
- **More precocious than Chandler**
- **Plump kernels, absence of shrivel**
- **Low blight**
- **Upright, moderately vigorous**
- **Kernel – 53%, 8.1g, light color**
- **?Consistent yield, ?Hull split**
- **Don’t prune heavily**

Gillet

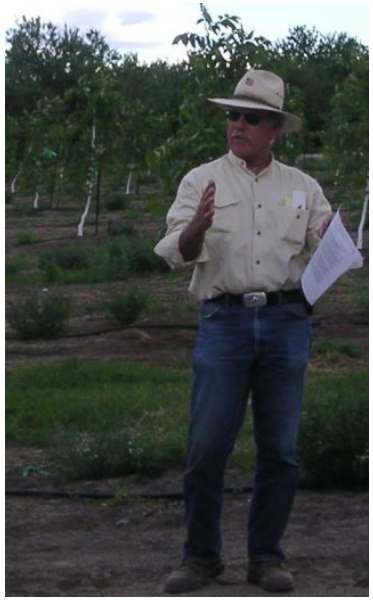
76-80 x Chico

- **Leafs – A few days after Payne**
- **Harvests – 2 weeks before Chandler**
- **Yield – similar to Tulare, Howard**
- **Blight - low**
- **Growth habit – Large vigorous tree**
- **Open canopy – light penetration**
- **Kernel – 51%, 7.8g, easy halves**
- **Light Color**
- **Relatively weak seals**

Robert Livermore

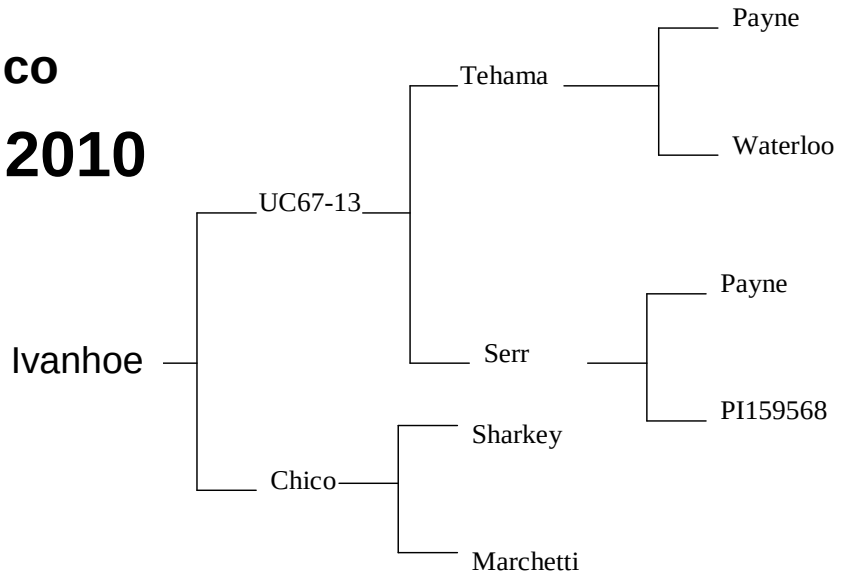


Ivanhoe



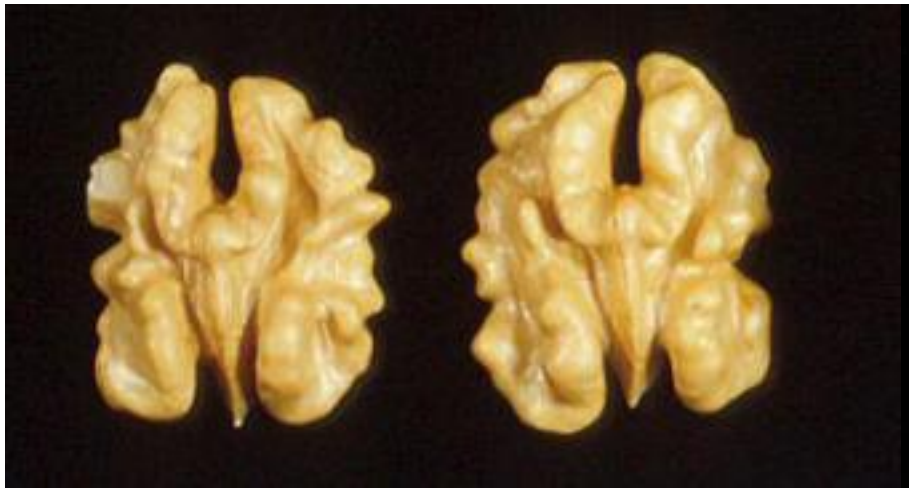
67-013 x Chico

Released: 2010



Ivanhoe

- Very early harvest date (Payne/Serr)
- Females bloom first
- Light kernel color
- High yield
- Blight susceptible
- Nut –smooth shells, watch size, seal
- Growth habit – small stature
- Grow it on Paradox
- Kernel – 57%, 7.4 g, easy halves



Ivanhoe Field Data Comparisons

Trait	Ivanhoe	Serr	Chandler
Leafing date	3/20	3/20	4/05
Peak female	3/29	4/08	4/23
Peak male	4/10	4/2	4/13
Harvest	9/12	9/19	10/08
Yield	7	6	7
Blight	3	3	1

Ivanhoe Nut Data Comparisons

Trait	Ivanhoe	Serr	Chandler
In shell wt. (g)	13.0 g	14.5	13.1 g
Kernel wt (g)	7.4 g	8.2	6.5 g
Percent kernel	57 %	56%	49 %
% Extra light	47 %	9%	55 %
% Light	44 %	66%	39 %

Ivanhoe

2013 Diamond Scoring

Average of 5 locations

Edible Yield	56%
RLI	56.2
Large sound	99%
Extra Light	57%
Light	36%
Nut weight	13.1g

Ivanhoe - Wheatland

Edible Yield	58%
Jumbo	98%
ExLt & Lt	94%
Nut weight	13.4g

Solano

UC 67-013 x Chico

- Early harvest date (Vina time)
- Light kernel color
- High yield
- Solid uniform shells
- Upright growth habit
- 54 % Kernel
- 8.0 g, easy halves
- Standard tree size

Solano

Field Data Comparisons

Trait	Solano	Vina	Chandler
Leafing date	3/27	3/27	4/05
Peak female	4/14	4/13	4/23
Peak male	4/03	4/5	4/12
Harvest	9/23	9/23	10/08

Solano

Nut Data Comparisons

Trait	Solano	Vina	Chandler
In shell wt. (g)	14.7 g	12.7	13.1 g
Kernel wt (g)	8.0 g	6.3 g	6.5 g
Percent kernel	54 %	49%	49 %
% Extra light	37 %	2%	55 %
% Light	56 %	43%	39 %

Solano


S505
91-096-3
S505
94-008-10
S505
95-064-12
S505 A
95-097-13
S505B
S505 A
S505B
S505

Grower Trial - Esparto, CA

Solano **Ivanhoe**

Solano

Solano

Yolo County 5th leaf

2013 Diamond Scoring

Average of 5 locations

	Ivanhoe	Solano
Edible Yield	56%	56%
RLI	56.2	56.5
Large sound	99%	99%
Extra Light	57%	58%
Light	36%	37%
Nut weight	13.1g	15.4g

Average Weight, Color, Leafing and Harvest Dates

Variety	Nut wt	Kernel wt	% kernel	Ex Light	Light	Leaf Date	Harvest date
Ivanhoe	13.0	7.4	57	47	44	3/20	9/12
Serr	14.5	8.2	56	9	66	3/20	9/19
Solano	14.7	8.0	54	37	56	3/27	9/23
Vina	12.6	6.2	49	2	44	3/37	9/24
Gillet	15.3	7.8	51	21	66	3/25	9/26
Tulare	14.0	7.5	54	4	76	4/1	9/28
Howard	14.1	7.1	51	16	63	4/5	9/29
Chandler	13.1	6.5	49	55	39	4/5	10/8

Suggested Pollenizers for Recent Releases

R. Livermore	Cisco, Franquette
Gillet	Payne, Serr, Vina
Forde	Ivanhoe, Howard, Tulare
Ivanhoe	Serr, Payne
Solano	Chandler, Tulare, Howard

93-028-20

Chandler x PI159568

- Mid-season in-shell competitor with Hartley
- Large, oval, smooth, very attractive nuts
- Has had almost no blight
- Very solid shells with good seals
- Tulare or earlier harvest
- Leafs a few days before Chandler
- 55% kernel
- 8.4 g kernels are consistently light , plump

- Observing for yield in young trees
- Watching performance in grower trials

93-028-20

93-028-20

00-006-227

Early - harvests with Vina
Leafs a few days before Chandler
Very good yield
Appears to hold color well
8.0 g kernels
60% kernel
Shells that are thin but sufficiently strong
Protogynous - bloom Is inverse of Chandler

00-006-227

(76-80 x O.P)

00-006-227 **Serr**

Pollenizers for Chandler with Inverse Bloom

00-006-227
Harvests with Vina, leafs a few days before Chandler
Appears to hold color well on the ground or after storage
8.0 g mostly extra light kernels, 60% kernel

03-001-977
Short-season - leafs with Chandler but harvests two weeks earlier
No blight and less husk fly than others in the same block
Shells fairly thin but strength appears adequate
8.2 g kernels, 59% kernel

04-003-143
Excellent kernel color
Leafs mid-season, harvests a week before Chandler
8.8 g plump kernels, Chandler-like light or extra light color
55% kernel with easy removal of halves

Current Needs – Future Directions

Husk Fly Resistance

Climate Change – Low Chill

Blight Resistance

Drought Resistance

Rootstock Development

Genetic Resistance to Rootstock Pathogens

- Crown Gall
- Nematodes
- Phytophthora
- Oak Root Fungus
- Lethal Paradox Canker
- Thousand Cankers

Specialty Crops Grant

USDA

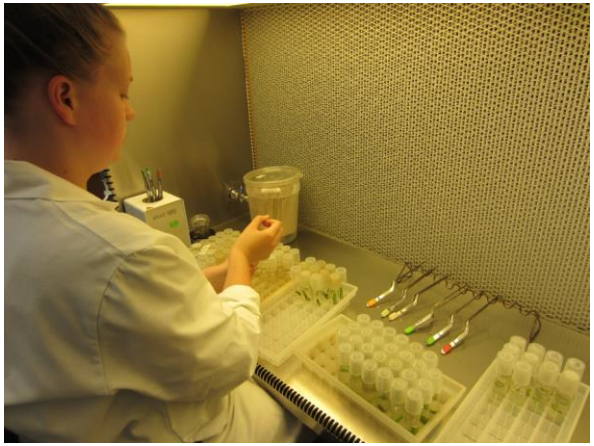
UC CE University of California Cooperative Extension

UC DAVIS DEPARTMENT OF PLANT SCIENCES College of Agricultural and Environmental Sciences

CALIFORNIA Walnuts

Clonal Rootstocks

Initiation in the Lab and Production of Multiple Copies of Each Individual



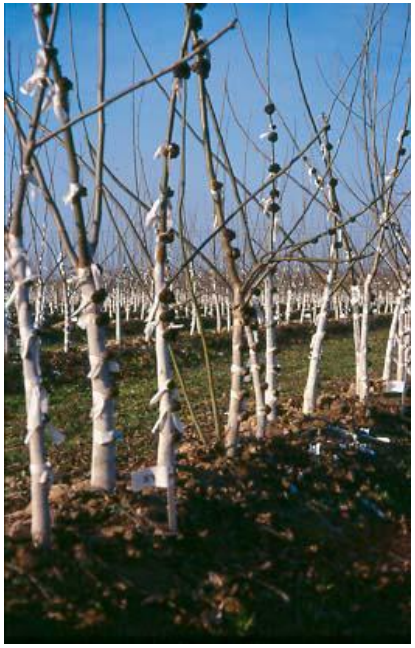
Rooting Lab Shoots to Make Plants

Greenhouse Production of Multiple Copies for Pathogen Testing



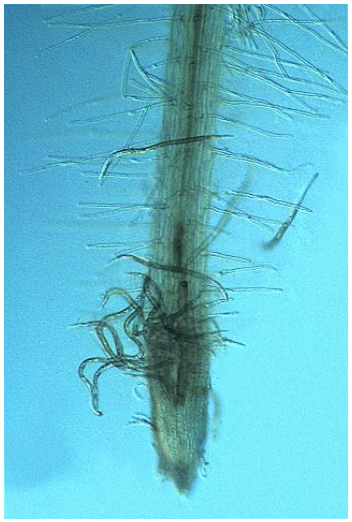



Screening for Crown Gall Resistance



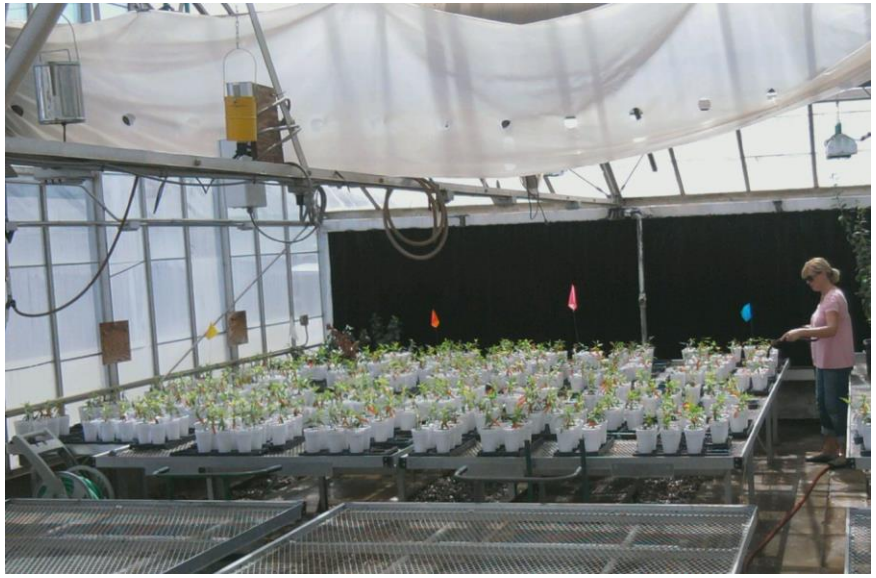
Screening for Nematode Resistance

Mike McKenry – UC Riverside



Phytophthora Resistance Screening

Greg Browne, USDA-ARS



Rootstock Field Trials

Vlach

Large old tree near Modesto

Originally cultured by John Driver

One of the first Paradox trees successfully tissue cultured

Has not exhibited genetic resistance in pathogen testing

Natural Resistance to Crown Gall

Dan Kluepfel - USDA-ARS

Susceptible

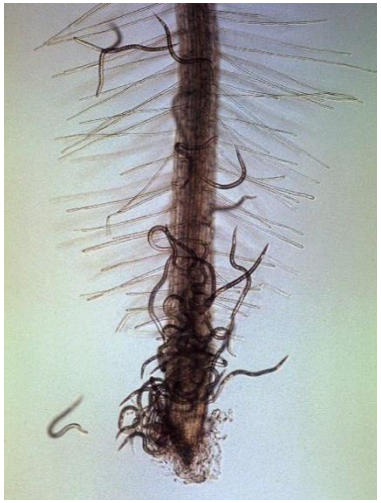
Potentially Resistant

VX211

Paradox

(*J. hindsii x J. regia*)

- Exceptional vigor
- Nematode tolerance
- Replant sites

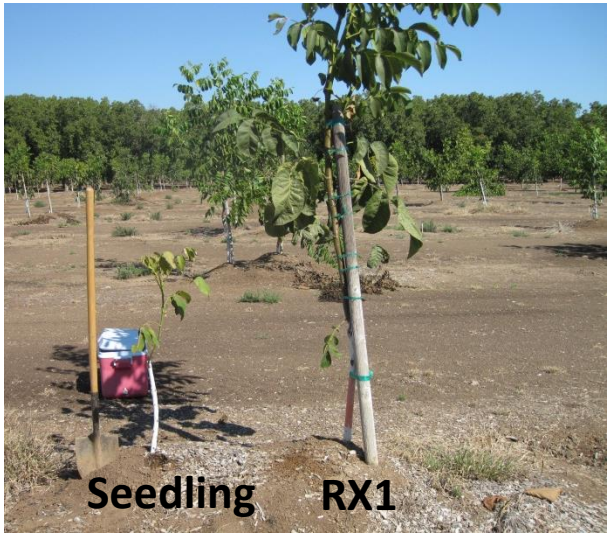


RX1

Paradox

(*J. microcarpa* x *J. regia*)

- **Resistance to *Phytophthora***
- **Excellent survival in wet sites**
- **Drought and salt tolerant ?**



Joe Grant - San Joaquin County Trial