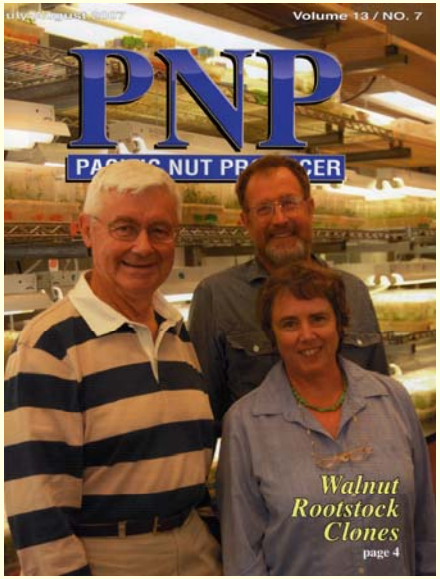
New Walnut Rootstocks

Gale McGranahan
Plant Sciences
University of California, Davis
ghmcgranahan@ucdavis.edu



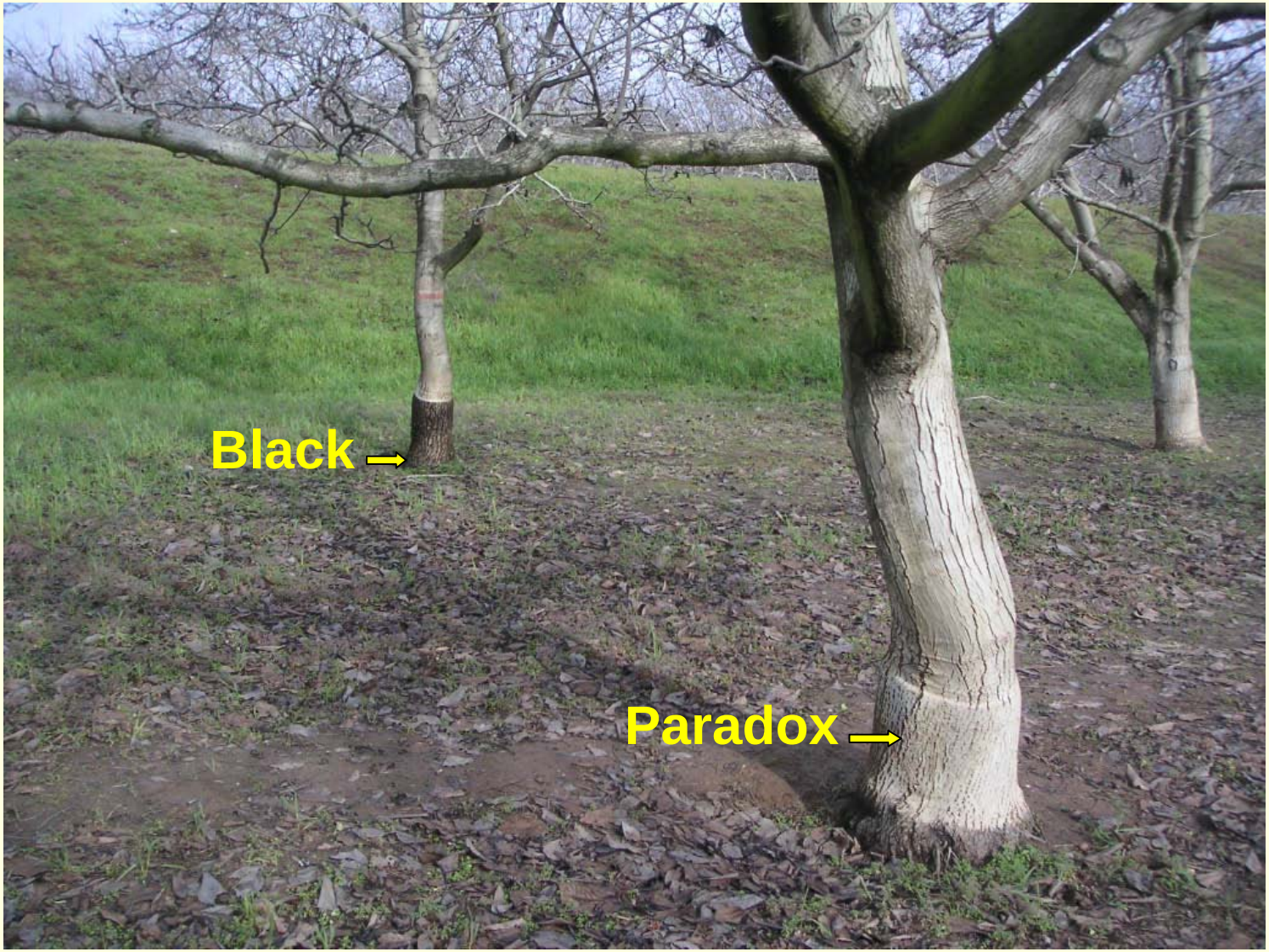
Old walnut orchard on black seedling rootstock, also known as NCB, Northern California Black.

There is more than one species of black walnut in California.

- **Northern California black walnut**
- Southern California black walnut
- Arizona black walnut
- Texas black walnut
- Eastern black walnut

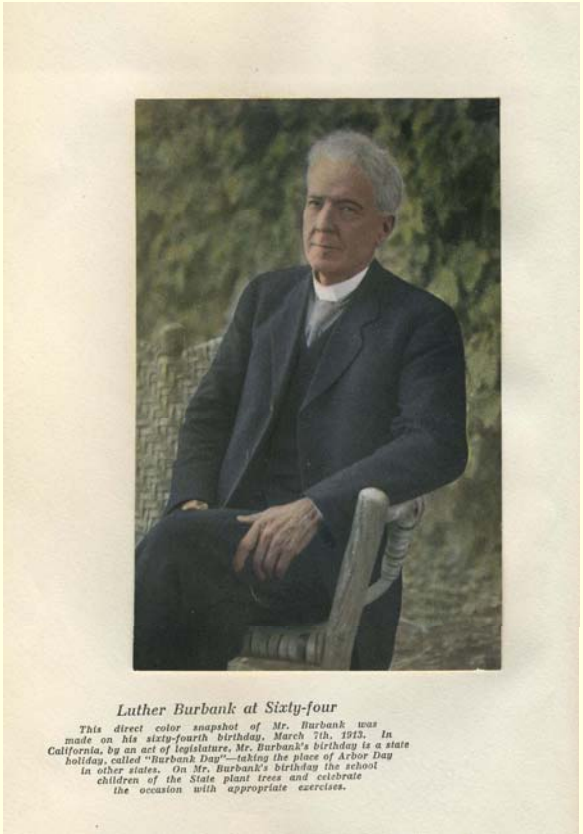
And the species makes a difference in performance.

Paradox Walnut Rootstock



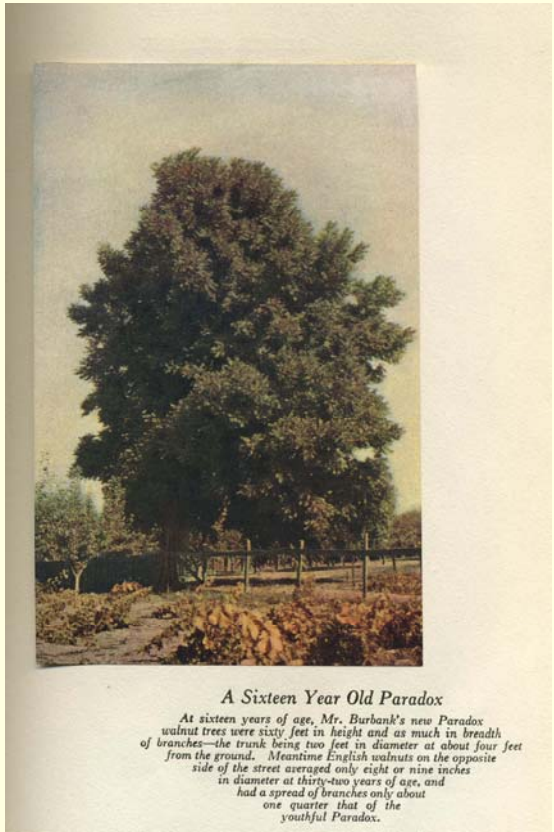
Paradox walnut

- Luther Burbank (1914) named and first described Paradox walnut: “As compared with seedlings of either the California or the Persian walnut, they manifested an enormous capacity for growth. Indeed they sprang forward at such a rate as presently to dwarf their pure breed relatives.”



Luther Burbank at Sixty-four

This direct color snapshot of Mr. Burbank was made on his sixty-fourth birthday, March 7th, 1913. In California, by an act of legislature, Mr. Burbank's birthday is a state holiday, called "Burbank Day"—taking the place of Arbor Day in other states. On Mr. Burbank's birthday the school children of the State plant trees and celebrate the occasion with appropriate exercises.



A Sixteen Year Old Paradox

At sixteen years of age, Mr. Burbank's new Paradox walnut trees were sixty feet in height and as much in breadth of branches—the trunk being two feet in diameter at about four feet from the ground. Meantime English walnuts on the opposite side of the street averaged only eight or nine inches in diameter at thirty-two years of age, and had a spread of branches only about one quarter that of the youthful Paradox.

What is a Paradox walnut?

- **Historically**: a hybrid seedling produced from a cross of northern California black walnut and English walnut.
- **Commonly**: a hybrid between any black species (usually northern California black walnut) and English walnut.
- Used as rootstock for English walnut.
- Can be seedling or clonal rootstock.

How is Paradox seedling rootstock produced?

- Nurseries usually have found their own unique black walnut mother trees that produce a high percentage of Paradox seedlings.
- Seed are planted in the nursery row to produce a one or two year old grafted or ungrafted tree.

Do different black walnut mother trees produce Paradox seedlings of similar quality?

- This was the start of the Paradox Diversity Study (PDS).
- What is quality in walnut rootstocks?
  - **Vigor, high yield efficiency, resistance to pests and diseases, graft compatibility and transplantability**.

Paradox Diversity Study

- Nurseries came together and donated seed. A double blind study. (1996).
- The Walnut Improvement Program made controlled crosses between English walnut and different black walnut species.
- Nurseries that grew the seed were Burchell, Dave Wilson and Driver.
- Seedlings were then distributed for testing against nematodes (McKenry), Phytophthora (Browne), and crown gall (McKenna first, now Kluepfel.)
- Seedlings were also planted in 4 field trials for long term evaluation by Farm Advisors.

Results of testing (screening)

- Some families of seedling Paradox were superior to others.
- Some individual seedlings were far superior.
- The far superior individuals needed to be re-tested.
- Micropropagation.

Micropropagation











Terminology

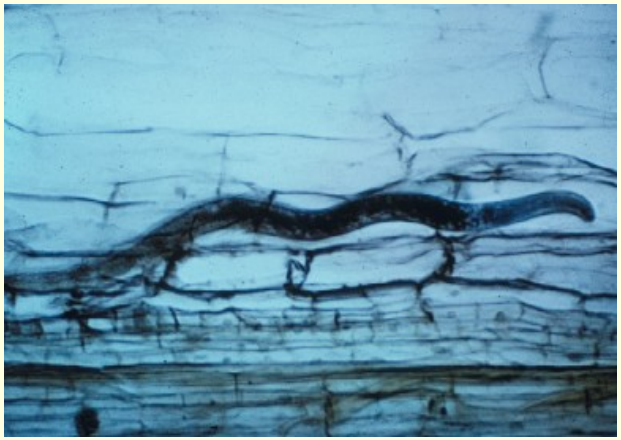
- **Clone** – A group of plants reproduced from a single individual by vegetative means (grafting, micropropagation etc.) that therefore have the same genetic make up.
- **Clonal rootstock** – Rootstock that is selected, (micro)propagated and made available for nurseries or growers.
- **Own-rooted varieties** - also micropropagated, but not grafted e.g. own-rooted Chandler

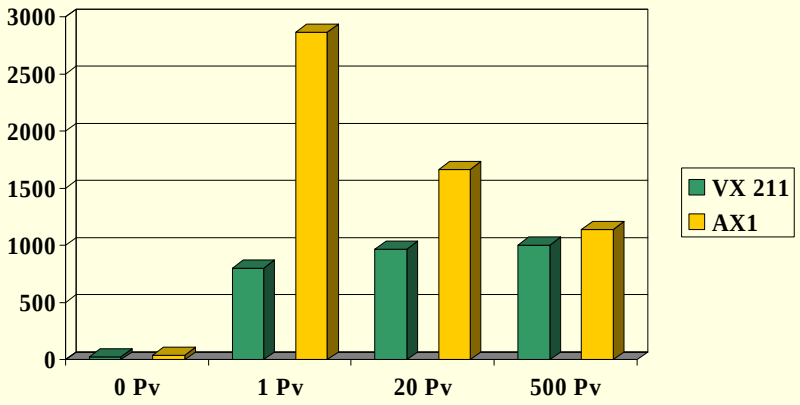
Nematode screening

Michael McKenry et al., UCR

- McKenry inoculated hundreds of seedlings from the Paradox Diversity Study with nematodes.
- Some families were better than others.
- Some individual seedlings were far superior.
- Those far superior seedlings were micropropagated and retested.

Nematode tolerant rootstock. Michael McKenry





VX211

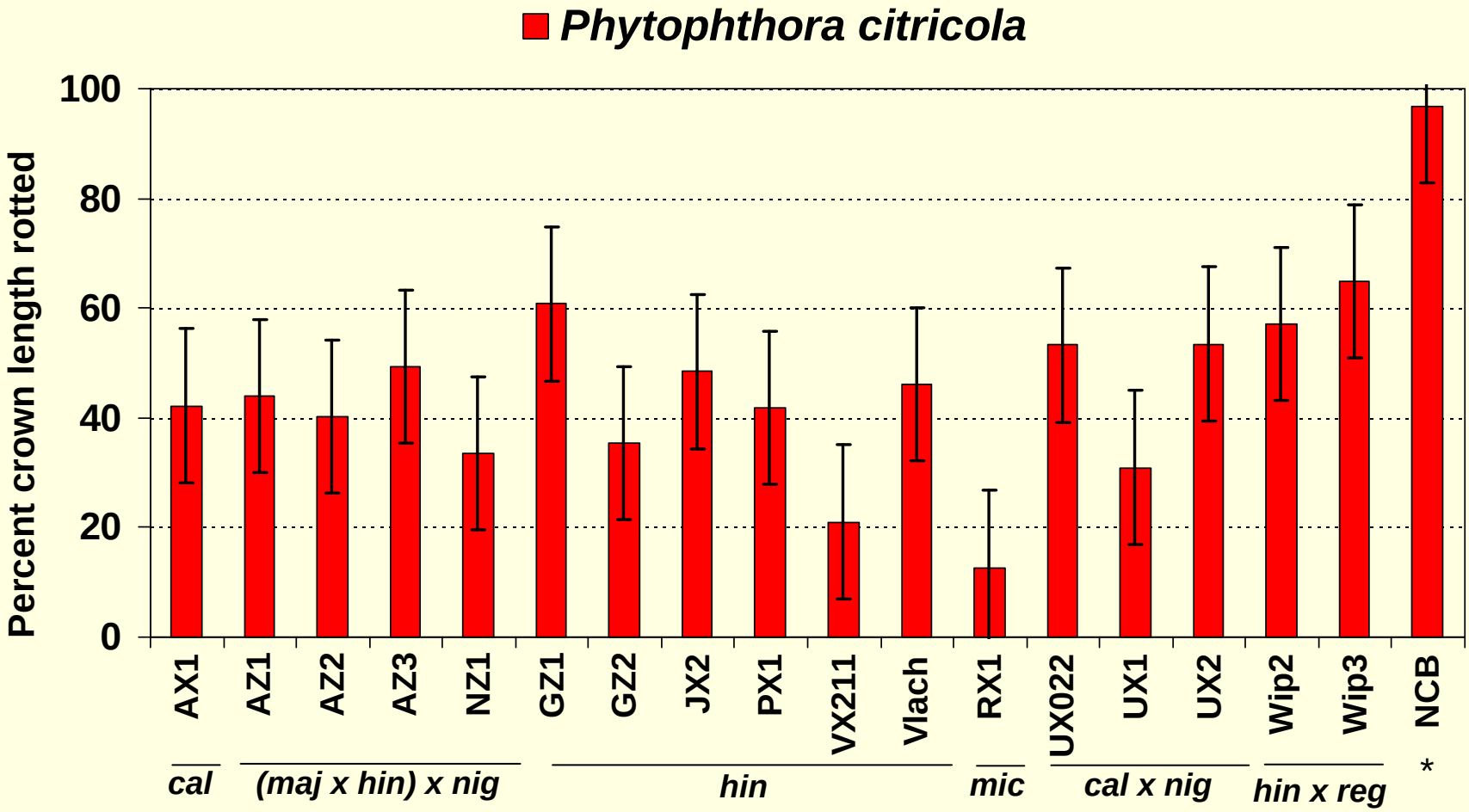
- **A clonal Paradox (NCB x English) walnut rootstock with**:
  - Exceptional vigor
  - Tolerance to nematodes
  - Some resistance to Phytophthora
  - Excellent survival in orchard replant trials
  - New large scale trials are underway
  - Nurseries are licensed to sell VX211

Phytophthora screening
Greg Browne et al., USDA/ARS

- Greg Browne inoculated hundreds of seedlings from the Paradox Diversity Study.
- Some individual seedlings were far superior.
- Those that were far superior were micropropagated and retested.

Phytophthora screening

Susceptibility to *Phytophthora citricola*, 2006 greenhouse evaluation



RX1

- A clonal walnut rootstock with resistance to *Phytophthora citricola* and *P. cinnamomi.*
- Texas black walnut X English walnut.
- Smaller tree, less vigorous than VX211.
- Excellent survival in orchard replant trials
- New large scale trials are underway
- Nurseries are licensed to sell RX1

Screening for crown gall resistance. McKenna, Kluepfel and Hasey

- McKenna screened hundreds of Paradox seedlings for crown gall resistance.
- Several Individual seedlings with apparent crown gall resistance were identified.
- Superior seedlings were micropropagated and retested by Kluepfel and Hasey

Crown gall screening

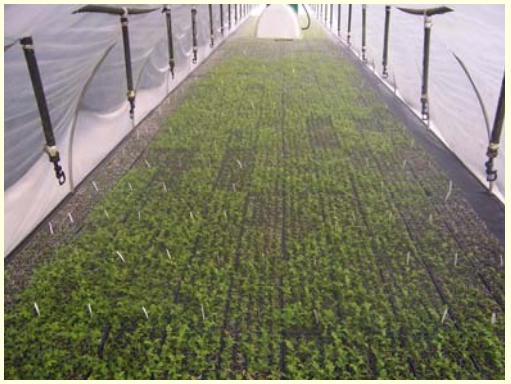
There is one Paradox clone that appears to have some resistance in greenhouse trials.

Kluepfel is now screening many walnut species and finding better ones.

Vlach

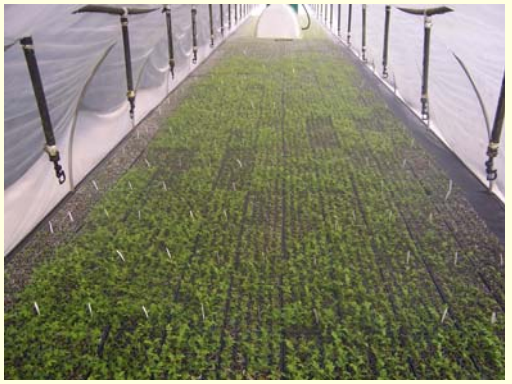
- One of the first Paradox clones to be micropropagated.
- 7-10 years in grower's fields.
- Susceptible to nematodes
- Phytophthora –variable response
- Vigorous
- Good survival

Labs that produce clonal rootstock for nurseries



- **North American Plants, Oregon**
  - VX211, RX1, Vlach
- **Vitrotech in Spain**
  - VX211, RX1, Vlach, Chandler, Vina, Serr, and Howard.
- **ProTree**
  - VX211, RX1, and Vlach
- **V-Tree**
  - VX211, RX1, Vlach, WIP3, Chandler
- **Walnut Improvement Program, UC Davis**
  - Only for experimental purposes. Over 40 different clones.

Type of material produced for nurseries



Duarte Nursery sells micropropagated plantlets directly to growers.

What nurseries have clonal walnut rootstock?

- Burchell Nursery- licensed for VX211 and RX1
- Duarte Nursery- licensed for VX211 and RX1
- Reisner Nursery- licensed for VX211 and RX1
- Sierra Gold Nurseries- licensed for VX211 and RX1
- Dave Wilson- licensed for VX211 and RX1
- Bonilla Nursery- licensed for VX211
- Green Tree Nursery- licensed for VX211
- Stuke Nursery- experimental stage
- Suchan Nursery- experimental stage

Clonal rootstock availability

- Most nurseries had some clonal paradox in the ground or in pots in 2008.
- Mainly VX211, RX1 and Vlach.
- Available grafted or not.
- Depending on growth some plants could be ready 2009 but more likely 2010.

Nursery stock to consider:

- Seedling (grafted or not)
  - Black
  - Paradox
- Clonal rootstock (grafted or not)
  - Vlach
  - VX211
  - RX1

  } ***Experimental***
- Own-rooted varieties (no rootstock)
  - Chandler
  - Vina
  - Serr
  - Howard

THANK YOU

- UC, UCCE and USDA researchers for collaboration.
- Nurseries for time, space and expertise.
- Growers for planting experimental trees and orchards.
- Walnut Marketing Board and IAB (CDFA) for funding.
- You for your attention and questions.