New Walnut Rootstocks

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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
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.”
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


- 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
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

![Graph showing percent crown length rotted for various strains of *Phytophthora citricola*.](image-url)
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
  \{\textit{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.