Walnut Trees in the Nursery Trade: Understanding Terminology, How they are Propagated, Availability and Clonal Rootstock Pest Interactions

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Helpful Terminology in Understanding Walnut Plant Material

Cultivar (cultivated variety) - A named group of plants within a cultivated species that is distinguished by a group of characteristics, e.g. refers to a vegetatively propagated clone, such as 'Chandler' or 'Howard'

Genotype - The genetic constitution of an individual.

Phenotype - An individual's observable characteristics or traits, e.g. flower color, or nut size.

Clone - Plants (scion or rootstock) reproduced from a single plant by vegetative methods (grafting, cuttings, layering, micropropagation). Plants produced in this manner have the same genotype as the parent. Variation can exist among clones from a given plant due to their interaction with the environment.

Micropropagation- Multiplication of plants under sterile *in vitro* conditions in a lab followed by hardening off in a greenhouse. *Most of the clonal rootstock and own-rooted walnut plant material in the trade is micropropagated.*

Grafted or budded plant - A plant whose roots are of one genotype and the shoots (scion) are of a different genotype, obtained by grafting or budding a cultivar onto a rootstock.

Own-rooted (also known as self-rooted) plant - A plant whose roots are of the same genotype as the shoots. It is obtained by micropropagation or rooting stem cuttings.

Seedling - A plant propagated from seed.

Plantlet – A plant propagated by vegetative methods e.g. micropropagation.

Liner – A young rooted plant used for transplanting into a nursery row or larger container.

A walnut plant can be purchased as a:

- **Rootstock** - A seedling or clonally produced tree, to be subsequently field grafted or budded to the desired English variety (cultivar). Until recently, most rootstocks have been seedlings: Seedling black, seedling Paradox hybrid (black x English), seedling English (no longer available). Clonal Paradox rootstocks with selected characteristics are now favored by many growers and are available from many nurseries. They are sold as potted plants or bare root trees.

- **Two-year old tree** – A two-year nursery product where the rootstock grows for a year and the cultivar (English variety scion) grows for a year in the nursery. Nurseries can either bud the rootstock in the fall of year one or graft the rootstock in the spring of year two.

- **June-budded tree –** A one-year old tree with the English variety budded onto the rootstock at the nursery in the spring or early summer. The nursery tree will be much smaller than a two-year tree, however, research and experience have shown that the grower's orchard tree at the end of the first growing season can be as large as or larger than a two-year tree. http://walnutresearch.ucdavis.edu/1996/1996_71.pdf.

- **Own-rooted (also known as self-rooted) tree** – An English variety rooted and grown on its own roots until ready for orchard planting. There is no graft or bud union.

Availability in Nursery Trade

Rootstocks (sold as ungrafted or unbudded trees): Seedling Paradox, seedling black, or clonal Paradox 'Vlach', 'VX211', or 'RX1' (and possibly other clonal rootstocks).

- Clonal rootstocks are sold as potted plants or bare root trees.

Nursery Grafted or Budded Trees: Various English varieties on seedling Paradox, seedling black, or clonal Paradox 'Vlach', 'VX211', or 'RX1' (and possibly other clonal rootstocks) sold as bare root trees.

Own-Rooted English Trees: 'Chandler' available in 2014. 'Howard', 'Tulare', or 'Serr' available by custom order (one year advance notice required for large quantities).

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Characteristics of available clonal Paradox walnut rootstocks based on available data[1]

Trait of interest	**'Vlach'**	**'VX211'**	**'RX1'**
Rootstock Vigor[2]	Vigorous	Highly vigorous	Moderately vigorous
Resistance to *Phytophthora citricola* (a cause of crown and root rot)	**LR**	**MR**	**MR-HR**
Resistance to *Phytophthora cinnamomi* (a cause of root and crown rot)	**LR**	**LR**	**HR**
Resistance to *Agrobacterium tumefaciens* (cause of crown gall)	**LR**	**LR**	**MR**
LR = low resistance	**MR** = moderate resistance	**HR**=high resistance	
Root Knot Nematode	**S-IT**	**S-ST**	
Root Lesion Nematode (*Pratylenchus vulnus*)	**HS-IT**	**S-ST**[3]	**S-IT**
	Nematode's ability to reproduce	**HS** = highly susceptible **S** = susceptible	
	Tree response to nematode	**ST** = some tree tolerance to nematode presence **IT** = tree intolerant to nematode presence, i.e. reduced tree vigor/health in presence of nematode	

[1]Based on data from ongoing UC and USDA-ARS trials
[2]In field trials with grafted trees, the vigor of the rootstock isn't necessarily reflected in the vigor of the scion, e.g. sometimes grafted trees on RX1 and Vlach are more vigorous than on VX211.
[3] Nematode tolerance due to a post-infection resistance mechanism

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