Growing eastern black walnuts in Missouri

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Introduction

Eastern black walnut (*Juglans nigra L.)* is a dual purpose tree, historically producing the highest quality hardwood lumber and veneer of any North American tree species.

It is also a source of edible nutmeats rich in protein and low in saturated fats, in comparison to other nut sources.

Introduction

The development of eastern black walnut as a nut orchard crop has been a major research focus at the University of Missouri Center for Agroforestry (UMCA) since 1998.

Components of the current UMCA black walnut program include:

1) germplasm acquisition and evaluation,

2) development of pedigreed seedling populations via controlled pollinations, and

3) establishment of field trials which focus on the performance of select germplasm over multiple environments.

Introduction

To date, a total of 213 nut cultivars and selections have been acquired and grafted in the UMCA germplasm repository. In addition, 1100 full sib seedlings derived from the “best” nut cultivars in the UMCA collection have been produced since 2002.

Black Walnut Breeding Program: Traits to Improve

- Annual/Early Bearing
- High Nut Yield
- Late Budbreak Date
- Early Nut Maturity Date
- Anthracnose Resistance
- High Kernel Percentage
- Ease of Extraction
- Kernel Color/Veination
- Nut Size

Phenology and Fruiting Descriptors

Budbreak date
Staminate bloom period
Pistillate bloom period
Dichogamy
Flowering vs. fruiting rate
Precocity
Harvest date
Season length
Alternate bearing index
Yield efficiency

Flowering vs. Fruiting

In both 2007 and 2008, an average of 33% of the pistillate blooms counted in early May resulted in filled nuts in July.

This flower/nut ratio was highly variable. Individual trees exhibited a consistent pattern over both sampling years (range from 0.00 to 66.3%).

Nut productivity of 10 black walnut cultivars in Missouri over 13 growing seasons.

CULTIVAR	Years to 100 nuts	TOTAL NUTS	MEAN % KERNEL	2002-08 TOTAL WGT (lbs)	MEAN A.B.I.	(IN) DIAMETER AS OF 1/09	(IN2) TCSA AS OF 1/09	2002-08 YIELD EFF. (lbs)
SAUBER#1(W)	9	1138	30.42	55.07	0.62	9.23	67.10	0.83
SCHESSLER	9.5	2078	27.91	94.12	0.64	8.62	58.39	1.62
SOUTH FORK	8	2295	27.14	96.62	0.65	9.43	70.05	1.36
SPARKS 127	9	2581	33.94	85.96	0.59	7.36	42.60	2.03
SPARKS 147	10	769.5	36.17	27.62	0.57	7.07	40.08	0.70
SPARROW	8	3996	26.85	149.77	0.42	9.05	64.51	2.28
SURPRISE	8	1466	28.70	69.15	0.69	10.22	82.03	0.84
TH/MYER	8	1961	31.33	98.76	0.34	8.35	55.03	1.81
THOMAS	7	1180	25.67	60.66	0.55	8.78	60.85	0.99
TOMBOY	9	1445	23.28	67.02	0.67	8.88	61.97	1.10

Black Walnut Breeding Program: Defining genetic gains for advanced generation selections

15 “best” control pollinated trees were selected in 2011, based on nut productivity over 5 seasons.

Selection criteria included:

- % Kernel
- % Filled
- Nut Weight
- Cumulative Nut Yield
- Yield Efficiency

All selections, plus 2 reference cultivars will be propagated in 2013 and established at 2 locations in 2014.

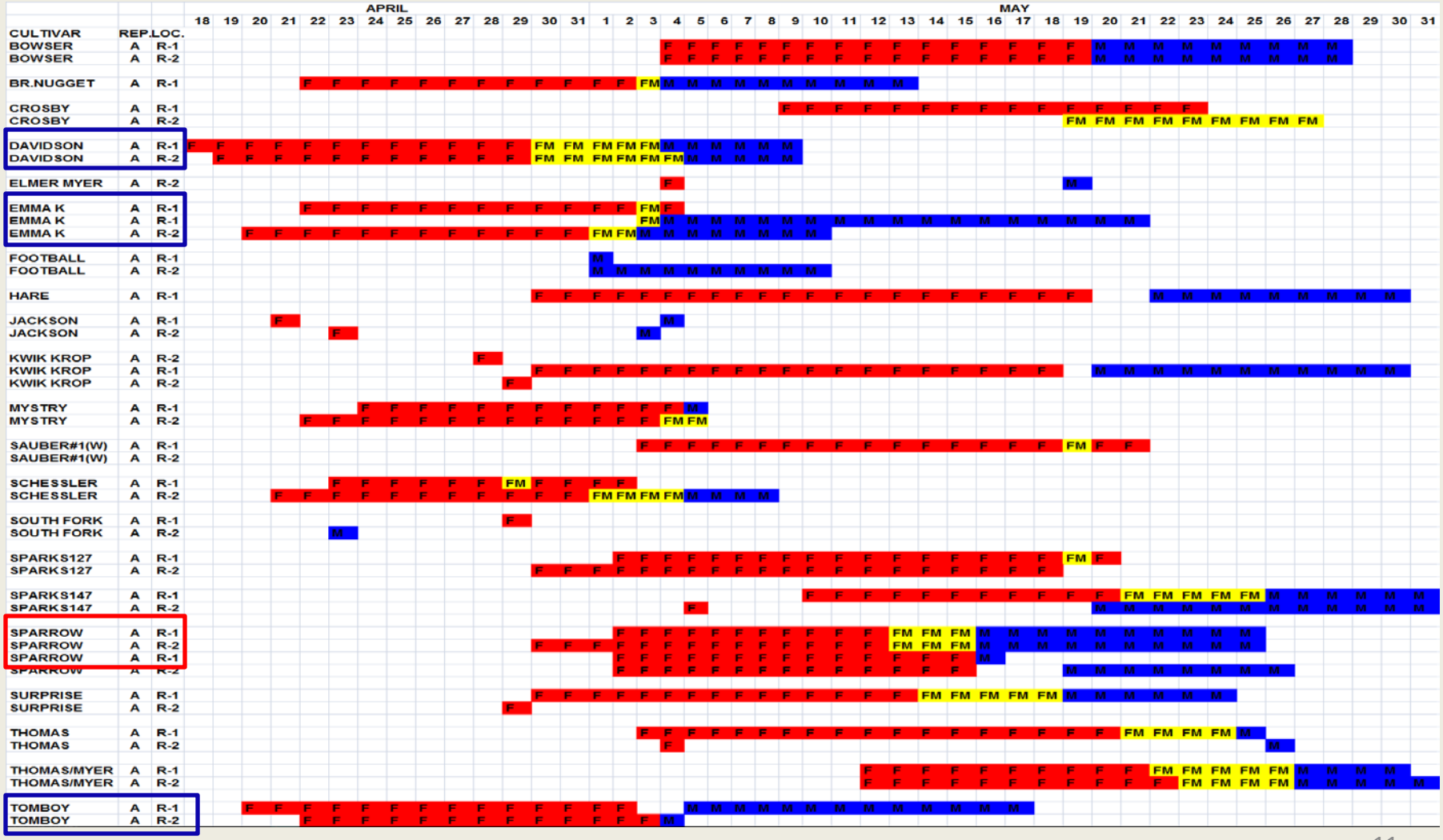
Since 2006, we have been using molecular markers in our breeding program to:

1) Confirm parental identities and seedling pedigrees

2) Identify full sibs within large open pollinated seedling families

3) Understand pollen flow patterns in black walnut orchards

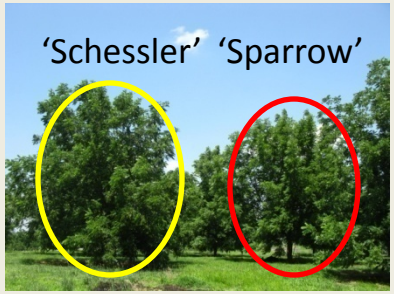
Defining pollen flow in walnut orchards: 2006 results



FEMALE PARENT: **SPARROW**

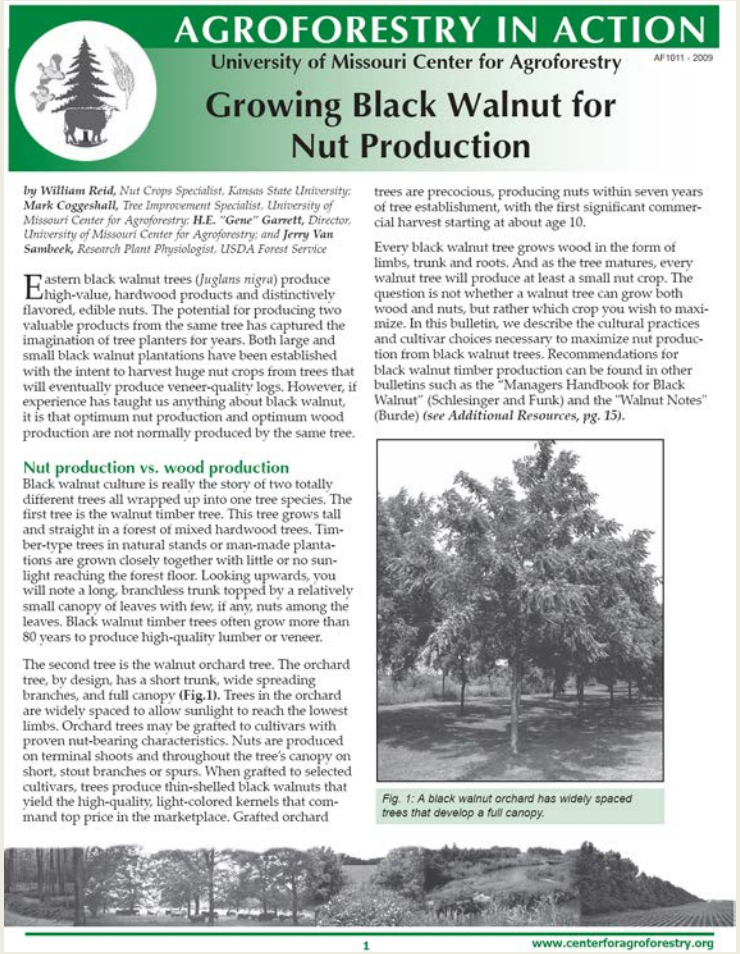
FEMALE RECEPTIVITY DATES: 5/17/08 THRU 6/3/08

MALE	START POLLEN SHED (DATE)	END POLLEN SHED (DATE)	# DAYS OVERLAP (# DAYS)	START POLLEN VS. 5/17 (# DAYS)	TOTAL SEEDLINGS (#)	TOTAL SEEDLINGS (%)	NEAREST MALE (meters)	NEAREST MALE (azimuth)
BOWSER	26-May	1-Jun	7	+10	2	0.29	30.5	N
BR. NUGGET	21-May	29-May	8	+5	20	2.92	34.1	NE
CROSBY	31-May	5-Jun	4	+14	1	0.15	30.5	S
DAVIDSON	18-May	28-May	11	+1	27	3.94	43.0	NE
EMMA K	20-May	26-May	7	+4	113	16.47	30.5	W
FOOTBALL	20-May	27-May	8	+4	9	1.31	48.2	SW
HARE	29-May	3-Jun	6	+13	2	0.29	30.5	E
HAY	1-Jun	8-Jun	3	+16	3	0.44	43.0	NE
JACKSON	24-May	30-May	7	+8	11	1.60	62.8	NE
MYSTRY	22-May	30-May	9	+6	3	0.44	60.9	S
SAUBER #1	31-May	5-Jun	4	+15	16	2.33	15.2	E
SCHESSLER	17-May	25-May	9	0	335	48.83	15.2	W
SOUTH FORK	11-May	19-May	3	-6	2	0.29	21.6	NW
SPARKS 127	27-May	1-Jun	6	+11	10	1.45	45.7	N
SPARROW	26-May	2-Jun	7	+10	4	0.58	SELF	-
SURPRISE	25-May	31-May	7	+9	47	6.85	34.1	SE
THOMAS	31-May	4-Jun	4	+15	2	0.29	15.2	SW
TOMBOY	22-May	28-May	7	+6	79	11.52	15.2	S
						%		
TOTAL KNOWN SEEDLINGS					686	62.03		
TOTAL UNKNOWN SEEDLINGS					420	37.97		
TOTAL SEEDLINGS					1106			



Davidson
Tomboy
Sparks 127
Sparrow
Hay
Br. Nugget
Emma K
Surprise
Kwik Krop
Daniel
Emma K
Jackson
Bowser
Football
Thomas
Sparks 147
Schessler
South Fork
Kwik Krop
Hare
Sparrow
Crosby
Mystry
Mystry
Elmer Myer
Crosby
Tomboy
Sparrow
Sparks 147
Bowser
Sparks 127
South Fork
Sparrow
Football
Thomas
Emma K
Kwik Krop
Daniel
Emma K
Br. Nugget
Hay
Jackson
Schessler
Surprise
Hare
Kwik Krop
Davidson
NORTH

For More Information….



AGROFORESTRY IN ACTION

University of Missouri Center for Agroforestry AF1011 - 2009

Growing Black Walnut for Nut Production

by ***William Reid,*** *Nut Crops Specialist, Kansas State University;* ***Mark Coggeshall,*** *Tree Improvement Specialist, University of Missouri Center for Agroforestry;* ***H.E. "Gene" Garrett,*** *Director, University of Missouri Center for Agroforestry; and* ***Jerry Van Sambeek,*** *Research Plant Physiologist, USDA Forest Service*

Eastern black walnut trees (*Juglans nigra*) produce high-value, hardwood products and distinctively flavored, edible nuts. The potential for producing two valuable products from the same tree has captured the imagination of tree planters for years. Both large and small black walnut plantations have been established with the intent to harvest huge nut crops from trees that will eventually produce veneer-quality logs. However, if experience has taught us anything about black walnut, it is that optimum nut production and optimum wood production are not normally produced by the same tree.

Nut production vs. wood production

Black walnut culture is really the story of two totally different trees all wrapped up into one tree species. The first tree is the walnut timber tree. This tree grows tall and straight in a forest of mixed hardwood trees. Timber-type trees in natural stands or man-made plantations are grown closely together with little or no sunlight reaching the forest floor. Looking upwards, you will note a long, branchless trunk topped by a relatively small canopy of leaves with few, if any, nuts among the leaves. Black walnut timber trees often grow more than 80 years to produce high-quality lumber or veneer.

The second tree is the walnut orchard tree. The orchard tree, by design, has a short trunk, wide spreading branches, and full canopy **(Fig.1).** Trees in the orchard are widely spaced to allow sunlight to reach the lowest limbs. Orchard trees may be grafted to cultivars with proven nut-bearing characteristics. Nuts are produced on terminal shoots and throughout the tree's canopy on short, stout branches or spurs. When grafted to selected cultivars, trees produce thin-shelled black walnuts that yield the high-quality, light-colored kernels that command top price in the marketplace. Grafted orchard trees are precocious, producing nuts within seven years of tree establishment, with the first significant commercial harvest starting at about age 10.

Every black walnut tree grows wood in the form of limbs, trunk and roots. And as the tree matures, every walnut tree will produce at least a small nut crop. The question is not whether a walnut tree can grow both wood and nuts, but rather which crop you wish to maximize. In this bulletin, we describe the cultural practices and cultivar choices necessary to maximize nut production from black walnut trees. Recommendations for black walnut timber production can be found in other bulletins such as the "Managers Handbook for Black Walnut" (Schlesinger and Funk) and the "Walnut Notes" (Burde) *(see Additional Resources, pg. 15).*

Fig. 1: A black walnut orchard has widely spaced trees that develop a full canopy.

1 www.centerforagroforestry.org

- Nut production vs. wood production
- Setting goals for the orchard
- Site selection
- Cultivar selection
- Orchard design
- Tree establishment methods
- Care of non-bearing trees
- Fertility and pest control
- Harvest and marketing of nuts
- Black walnut grower's calendar

http://extension.missouri.edu/explorepdf/agguides/agroforestry/af1011.pdf

Table 1: Recommended Black Walnut Cultivars							
Cultivar	**Leafing Date[1]**	**Spur Fruiting**	**Anthracnose Susceptibility**	**Nut Weight (g)**	**Percent Kernel**	**Alternate Bearing Tendency**	**Ripening Season[2]**
Sparrow	15	no	low	19	32	medium	early
Sparks 127	12	yes	high	15	33	high	early
Tomboy	7	no	low	22	27	medium	early
Emma K	5	yes	medium	19	34	high	mid
Mintle	4	no	high	16	31	high	mid
McGinnis	4	yes	medium	17	31	high	mid
Drake	17	no	high	19	30	medium	mid
Kwik Krop	15	yes	medium	17	31	high	mid
Sparks 147	21	yes	medium	17	36	medium	mid
Sauber	13	yes	high	15	32	high	mid
Football	6	yes	high	22	29	high	late
Hay	23	yes	low	22	32	medium	late
Rupert	8	yes	low	18	26	low	late
Surprise	13	yes	high	20	33	low	late
Thomas	22	no	low	22	24	medium	late

[1]Leafing date is recorded as days after Davidson, the earliest leafing cultivar under trial in central Missouri. Average leafing date for Davidson in central Missouri = April 12.

[2]Average ripening dates in central Missouri: **early** = Sept. 1-14; **mid** = Sept. 15-28; **late** = after Sept. 28.

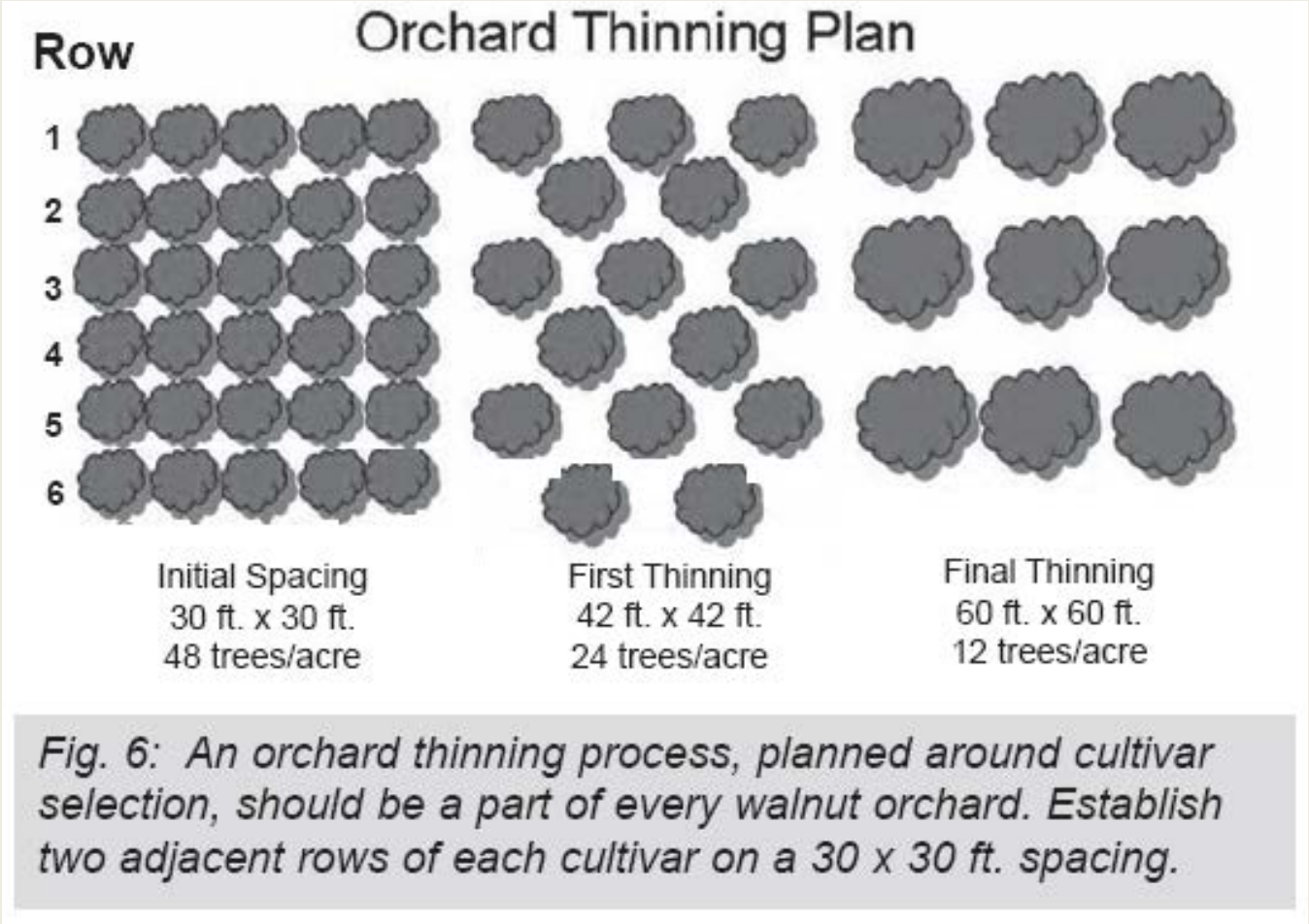


Fig. 6: An orchard thinning process, planned around cultivar selection, should be a part of every walnut orchard. Establish two adjacent rows of each cultivar on a 30 x 30 ft. spacing.

Month	Non-bearing Trees	Bearing Trees	Pest Management
Jan.	Plan grafting efforts	Maintain equipment	Maintain equipment
Feb.	Collect scionwood Tip prune trees	Prune orchard	
March	Fertilize trees Plant bare-root stock Tip prune	Prune orchard Fertilize trees	Scout for walnut shoot moth
April	Apply weed control	Apply weed control	Spray for walnut shoot moth as needed at budburst
May	Field-graft trees to recommended cultivars	Keep groundcover mowed	Scout for curculio; spray for anthracnose & walnut curculio, as needed, after pollination
June	Water newly planted trees Stake new grafts	Keep groundcover mowed Thin nut crop if needed	Scout for walnut aphids and lacebugs
July	Prune off new shoots below new grafts Tip prune	Keep groundcover mowed Irrigate as needed	Scout for caterpillar & fall webworms
Aug.	Make sure newly plant-ed trees have adequate water	Keep groundcover mowed Irrigate as needed	Scout for walnut husk fly
Sept.	Establish cool season cover crops	Harvest promptly Clean and market nuts Irrigate as needed	
Oct.	Plant container-grown stock	Finish nut harvest Fertilize trees	
Nov. & Dec.		Market crop!	

Genetic Variability Among Eastern Black Walnut Cultivars

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Flowering and fruiting characteristics available on handout.

http://extension.missouri.edu/publications/DisplayPub.aspx?P=XM1001

For more information…

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