

Black Walnut Harvesting Costs--The 50 Percent Factor

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Ultimate success of agroforestry systems, especially those that incorporate nut tree plantations with intercropping, will depend on their profitability. As with more traditional crops, harvesting and labor costs are major considerations. As much as half or more of the nut crop income from a black walnut agroforestry system may be required to pay the harvesting costs.

It is commonplace that at least 50 percent of the nuts harvested from scattered native walnut or pecan trees goes to itinerant or contract hand nut pickers. Black walnut pickers often receive the whole crop. Contract pecan harvesters with mechanized harvesting equipment charge 50 to 70 percent of the crop for their services. However, they also may provide other pre-harvest labor such as pruning, stick picking and mowing, even spraying for insects.

While a 50 percent charge for contract harvesting may seem exorbitant to a plantation owner, it must be determined: "50 percent of what?"

A dedicated hand picker might harvest 500 pounds of hulled black walnuts in a day. At 10 cents per pound that's only \$50 a day. It's quickly evident why most black walnut pickers do not want to share the proceeds. Even in a plantation setting where the nuts are abundant and pickers do not need to travel far between trees, the daily wage still would be quite small for the labor involved.

Plantation size and the ultimate growth of the industry are closely tied to how many pounds of nuts can be harvested in a day and at what cost.

If we accept that one person can hand harvest up to 500 pounds of hulled black walnuts in an 8-hour day, we can begin to measure nut harvest efficiencies. The 500-pound marker certainly isn't an average of what most hand pickers actually harvest. Most do not or cannot or will not work 8 hours a day. It has been proven on the Hammons Sho-Neff Plantation at Stockton, Mo., that dedicated pickers can harvest that amount.

It also has been shown from historical weather records that there are an average of 20 excellent harvesting days in the fall. Of course, there can be more in some years, less in others and growers will definitely extend the season by working some "not so good" days. But for purposes of comparison, let's stick with the 20 days and 500 pounds per day for each worker. That means that a single picker can harvest only 10 acres of black walnut trees that produce an average annual crop of 1,000 pounds per acre ($20 \times 500 = 10,000$ pounds).

If the plantation yields 2,000 pounds of nuts per acre, a single picker could harvest only 5 acres. The reality then is that a plantation owner can plant only the number of acres he or she has labor or equipment available for the harvest.

If hand labor is not available, and it probably won't be; who else but the plantation owner is going to work 8 hours a day for \$6.25 an hour ($500 \times 10\text{cents} = \$50 / 8 = \$6.25$), then mechanical

harvesting no longer is an option, but a necessity. In fact, hand labor other than family labor for picking nuts for their own use or a limited niche market, probably isn't an option at all. The only time hand labor would be attractive would be in the case of a limited acreage of high-value nuts, processed and direct-marketed to special buyers. The price would have to be set so it covers production, harvesting, processing and marketing costs plus a reasonable profit.

However, for this example, let's assume we are producing for the commercial nut market (Hammons Products Co.).

It is a foregone conclusion among pioneering black walnut plantation owners that some kind of mechanical harvesting is necessary. Several approaches have been tried.

Some of these systems do little more than remove some of the back-breaking stooping and bending work. Spreading tarps around trees to collect falling or shaken nuts may actually increase labor costs. A more mechanized approach of mounting tarps on a tractor frame may also increase costs and not gain any economies.

The modified golf ball retrieving units offered by Bag-A-Nut may be handy for harvesting a small orchard, but the efficiency of these small push-type or lawn tractor-mounted units is questionable. Cost of the 16-inch model is about \$250 while larger units may cost several hundred dollars.

At least two commercial nut harvesting systems lend themselves for adaptation to black walnut. The first is English walnut harvesting equipment, manufactured mostly in California where the English walnut is most prevalent. It appears to perform well enough, but initial cost may be more than the black walnut market can bear. The system now in use at Hammons Products Company at Stockton, Mo. is made by Weiss-McNair. This sweeper-harvester combination costs about \$35,000 new. A tree shaker would add another \$5,000. Total system cost would be about \$40,000 not including tractor and transport equipment necessary. We assume most multi-crop farming operations would already have this equipment. The purpose here is to compare only the costs of equipment specific to the nut harvesting operation.

The second harvesting system under consideration is a modified pecan harvesting machine manufactured by NH Savage of Medill, Oklahoma. In preliminary trials using the company's smallest model, it was determined that the harvester will pick up walnuts (with hulls on), but needs several modifications. A larger screening chain with at least 3.5-inch openings is necessary to allow the largest black walnuts to pass through while still screening out the largest sticks and other trash. The augering system, both the horizontal transport and the elevating augers, should be increased in diameter to handle the large walnuts with hulls on. It might be possible to replace this augering system with a conveyor belt that would be useful for both walnuts and pecans.

The trash screen on the elevator auger also must be opened up to 3/4 inches to allow more trash, especially crushed hull, to be expelled. However, some of the crushed hull would be eliminated by the larger augers or conveyor.

It also is suggested that the pickup header on the machine needs to be free-floating with a gauge wheel to accommodate uneven ground.

With these adaptations, it is felt that the NH Savage equipment would perform well enough. Savage recently introduced a new model pecan harvester with 6-foot header that incorporates some of these design changes. However, it has not been tested on black walnut.

It is roughly estimated that an NH Savage harvester of equivalent size to the Weiss-McNair unit could harvest up to 30,000 pounds of black walnuts with hulls in an 8-hour day. That would yield about 12,000 pounds of hulled nuts per day (40 percent of total weight).

Now we have to get back to the question: “50 percent of what?”

The capability of the harvester mentioned above would allow an operator to cover 8 to 10 acres per day when the per-acre yield is between 1,000 and 1,500 pounds of hulled nuts. From experience in pecan plantations, it is estimated that 10 to 12 acres a day is about all that can be covered no matter what the yield may be. Therefore, our harvesting capability may set the minimum yield goals we strive for.

Harvesting capability also will largely determine the number of acres needed to reach the economic potential for ownership of the equipment. The harvesting capacity used above would allow an operator to harvest 40 acres yielding 1,000 to 1,500 pounds of black walnuts per acre in 3 to 5 days. Long-term weather records indicate that most areas of Missouri have an average of 20 days of open harvesting weather each fall. We could extrapolate that we might be able to use the harvesting equipment for at least 20 days most years on at least 160 acres. That number of acres, whether owned or under custom harvest, would spread the cost of the equipment over the most economic time period.

Cost of machinery ownership based on 160 acres, or better yet, 160,000 pounds of hulled nuts, would be figured by the following formula: Original cost of machine minus salvage value (10 years) divided by 10 plus interest [original price plus salvage value divided by 2 to get an average annual interest value] times 10 percent plus maintenance [2 percent of original investment].

The annual cost of a harvesting machine selling for \$15,000 would be \$2,300. A more useful cost figure is cost per pound. If an operator could harvest 160,000 pounds annually, the per-pound cost would be almost 1.5 cents.

Of course, there are other machines and expenses in this harvesting system. A tree shaker at a cost of approximately \$5,000 would be necessary. How the nuts are marketed, whether in the hull and transported to a buying station, or hulled on the farm for retail or wholesale marketing will determine the need for buying a huller and washer. These two items could add \$1,500 each, perhaps more. As trees become more mature, it likely will become necessary to use a trash or stick rake to remove debris before harvest. This could add another \$3,000. Total cost for new equipment with the NH Savage unit could reach \$26,000 or 2.5 cents per pound or more cost.

Labor to operate the machinery also must be added. It most likely would require a three-man team, especially if the hulling is done on the farm simultaneously as the harvesting. Taking the nuts to a commercial huller might reduce farm labor but would increase per-pound cost by 3 cents (normal huller operator compensation).

Three men at \$6 per hour times 8 hours equals \$144 times 20 days equals \$2,880 divided by 160,000 pounds equals 1.8 cents a pound.

Other machinery costs such as farm tractors (most likely two) plus wagons or truck for transportation must also be added. That most likely would increase harvesting costs another cent or two.

Harvesting costs could easily mount to 5 or 6 cents per pound or more under the best of conditions, depending on total pounds picked. That's half or more of the current commercial price of 8 to 10 cents a pound for hulled nuts at a commercial huller. Add 3 cents to that if nuts are hulled on the farm.

The best of conditions dictate that a harvester must be operating in a plantation environment where nuts are conveniently accessible and plentiful. A crop of at least 1,000 pounds per acre seems to be a necessity just to make mechanical harvesting feasible.

These figures are predicated on a minimum yield of 160,000 pounds harvested in 20 days. Any change in that figure, i.e. less than 160,000 pounds, increases rather dramatically the cost of harvesting equipment on a per-pound basis. Extending the acreage or the season is not a real option since days of optimum harvesting conditions are limited.

Although a reduced yield likely would result in reduced labor costs (fewer days), the annual machine ownership costs would be the same.

It would appear that under current nut pricing conditions, even with ownership of harvesting equipment, the cost of harvesting is likely to be at least half the crop.

The solution to this dilemma does not lie in higher yields, at least not a big part of the solution. The machine's capacity is limited to the number of nuts that can be picked up in 20 harvesting days. A heavy crop might increase that capacity somewhat.

The real solution lies in pricing the crop at a reasonably profitable level.

BLACK WALNUT AGROFORESTRY -- MISSOURI BASIC SYSTEM (ALTERNATIVES)

This system information sheet can be used to collect alternative agroforestry system cost, income and timing information needed to calculate profitability and make comparisons with the basic system.

Alternative System Design:

Row and tree widths -- (40 by 20 feet = 54 trees/acre)

Site Index -- (65)

Rotation = number of years to final harvest -- (60)

Tree species -- (Eastern Black Walnut)

Planting method -- (post hole digger)

Rootstock -- (selected cultivar bareroot seedlings)

Field grafted -- (custom grafted = \$3/tree)
Alley crop -- (orchard grass/red clover)
Salable crops -- (nuts, timber, hay)

Crop Yields:

Nuts: (Year 11-15 = 500 pounds/ac.)
(Year 16-20 = 750 pounds/ac.)
(Year 21-30 = 1,000 pounds/ac.)
(Year 31-40 = 1,500 pounds/ac.)
(Year 41-60 = 2,000 pounds/ac.)
Price: (25 cents/pound)

Timber:

(Commercial Thinning at Year 26. Remove 27 trees at 12 in. DBH with 9 ft. log = 16 board ft.)
Price: (50 cents/board ft.)

Final Harvest:

(27 trees @ 25 inches DBH with 9-ft log = 180 board feet)
Price: (\$1/board foot)

Hay: Annual net income (\$60/acre/year)

(Livestock = annual net income)
(Annual crops = annual net income)
(Long-term crops--ornamentals, ginseng, etc. use cost and income by Years.)
(Services--lease hunting, etc, use annual net income)
(Government programs and cost share = annual net income)

Costs of individual practices:

Site preparation: (\$10/ac.)
Rootstock: (\$1/seedling = \$54/ac.)
Planting: (\$1/seedling = \$54/ ac.)
Grafting: (\$3/tree) (70% success rate annually)
(Year 3 = 54 trees x \$3 = \$162/ac.)
(Year 4 = 16 trees x \$3 = \$48/ac.)
(Year 5 = 4 trees x \$3 = \$12/ac.)
Herbicide: Application cost (\$5/ac.)
Chemical cost (Year 1 thru 6 = 3-ft. strip on each side of row = \$8/ac.)
(Year 7 thru 8 = 4-ft. strip each side of row = \$9/ac.)
(Year 9 thru 60 = 6-ft. strip each side of row = \$11/ac.)
Fertilizer: (60-30-30 annually beginning Year 2 = \$27/ac.)
(Application cost: \$5/ac.)
Overseeding: (Red clover overseeded every 4 Years at 8 pds/ac. x \$2 = \$16/ac.)
(Application cost: \$4/ac.)
Pruning: (Year 7 = \$14/ac.)

(Year 12 = \$14/ac.)

Management: (All those odd annual jobs we hadn't counted on: \$7/ac./Year)

Other specific practices needed for this alternative system: (Cost/ac, Years performed)

SPECIALIZED AGROFORESTRY PRACTICES COSTS

Planting: Dibble Bar -- .20/tree
 Transplanter -- .12/tree
 Post Hole Digger -- .50/tree
 (Double these rates if have custom contractor perform service)

Seedlings: Missouri State Nursery -- .50 ea. (after culling half)
 Selected cultivar -- \$1 ea. (greenhouse grown)
 RPM selected cultivar -- \$8 ea. (in 2-gal. pot)
 RPM grafted cultivar -- \$12 ea. (in 2-gal. pot)

Weed mats/inc. installation:
 \$1 ea. (no herbicide application until Year 5)

Field Grafting: (Includes scionwood) \$3/tree

Pruning/hauling debris: .26/tree

Labor: \$7/hour

(The accompanying table demonstrates the economic necessity of harvesting as many pounds of nuts as possible within the ideal harvesting period. Machinery ownership cost (interest, depreciation and maintenance) are the same each year no matter how many pounds of nuts are harvested. Hourly tractor and labor costs vary with the amount of time required to harvest the crop.)

MECHANIZED HARVESTING COST (PER POUND) FOR EASTERN BLACK WALNUT

Number of Harvesting Days	1	2	3	4	5	10	15	30
Machinery Ownership Costs	\$4,500.	\$4,500.	\$4,500.	\$4,500.	\$4,500.	\$4,500.	\$4,500.	\$4,500.
Hourly Tractor/Labor Costs	\$288.	\$576.	\$864.	\$1,152.	\$1,440.	\$2,880.	\$4,320.	\$8,640.
Total Annual Cost	\$4,788.	\$5,076.	\$5,364.	\$5,652.	\$5,940.	\$7,380.	\$8,820.	\$13,140.
Cost per pound @ 5,000 lbs.	\$.96	\$.50	\$.36	\$.28	\$.24	\$.14	\$.12	\$.08
Cost per pound @ 10,000 lbs.	\$.48	\$.25	\$.18	\$.14	\$.12	\$.07	\$.06	\$.04