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Division of Marketing
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2001 Project Final Report

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Commercial Hazelnut Development Project

Final Report

a. Description of original intent & perceived benefit to WI agriculture.

The intent of the Commercial Hazelnut Development Project was:

- 1) Establishment of the first commercial prototype hazelnut plantation in the state of Wisconsin
- 2) Development of a report on start-up costs and cash flow projections for a commercially viable hazelnut plantation
- 3) Provide educational opportunities on hazelnut production to Wisconsin Farmers

The goal of this project was to create viable economic opportunities for farmers in Wisconsin through the development and implementation of commercial hazelnut plantations.

The objectives of the project were carried out in accordance with the original grant proposal and all objectives have been met.

This project was undertaken to determine whether hazelnut production was economically feasible for commercial production in the state of Wisconsin.

b. Summarize how the project created or achieved benefits to the agricultural industry.

The Commercial Hazelnut Development Project specifically has led to the development of a new agricultural product for Wisconsin. Until this project was initiated, few if any landowners in Wisconsin knew about -much less were growing- hazelnuts as an agricultural crop. As a result of this project, at least 10 landowners in the state will be growing hazelnuts for production. The impact of this project on widespread adoption of hazelnut production will not be realized for several years. However, the results of this project have shown both the economic potential of hazelnut as a cash crop, and the documentation landowners need to integrate this crop into their operation.

c. Evaluation of the results and benefits of the project, including meeting original expectations.

The original expectations outlined in the grant proposal have been met. The first commercial size hazelnut plantation in Wisconsin has been established at New Forest Farm. The planting included 10,478 hazelnuts on approximately twelve acres. Although this project has many accomplishments, the establishment of this first of its kind planting in the state constitutes a major achievement in the progression of woody agriculture in Wisconsin. This prototype planting will open the door for many landowners to implement hazelnut production into their farming system. The New Forest Farm planting is a showcase on how landowners can diversify through the integration of agroforestry into traditional agriculture. The Commercial Hazelnut Development Report has documented establishment costs and cash flow projections for hazelnut production. This data was greatly needed for landowners to realize the financial opportunities available in hazelnut production.

The results of The Commercial Hazelnut Development Project demonstrate that Hazelnuts have potential as a low-input, low-maintenance crop in Wisconsin. The results from this project indicate that establishment costs for Badgersett Hybrid Bush Hazelnut are approximately \$3,847.17 per acre with annual income possibilities of an average of \$462.69/year if the nuts are sold as low-grade, processing

nuts. At these prices and yields, Hazelnut is obviously not a get-rich-quick crop. It is, however, an easy to grow crop with large, dependable existing international markets.

d. Description of information or educational materials developed through the project

The attached document contains the Commercial Hazelnut Development Final Report which provides detailed spreadsheets and written interpretations of information on cost of establishment, and cash flow projections for a commercially viable hazelnut plantation.

The information contained in this report was presented to the public three times. Two presentations were given at the Midwest Organic Conference and one presentation was given at the Opportunities in Agroforestry Conference. The total number of landowners that received information through these workshops was estimated to be three-hundred and fifty. Another 30 landowners were mailed information regarding the project as of 06/30/2000. One on-farm workshop was held at New Forest Farm, however, adverse weather limited participation. Additional presentations were given to the Southwest Badger RC&D council, the State Association of R&D councils, and UW Stevens Point Student Chapter of the Society of American Foresters.

e. Future projections resulting from receipts of grant funds.

This project has undoubtedly developed a huge interest in hazelnut production as a cash crop in Wisconsin. To the best of our knowledge, there will be approximately six Wisconsin landowners planting over one acre of hazelnuts in 2001. As a result of the positive outcome of the feasibility study, we are projecting that number to double in 2002. In addition, there have been commitments from four WI tobacco growers to plant hybrid hazelnuts in 2001.

Since the start of this project, Southwest Badger RC&D and Mark Shepard have received over 100 calls regarding hazelnut production. We estimate that number will triple as the final report is distributed.

f. Other appropriate information related to the project.

Many exciting developments have occurred since the start of this project. One important development could have major implications for value-added processing of hazelnuts. In August of 2000, Badger Oil Company completed the first commercial press of hazelnut oil from Midwestern-grown hazelnuts. The oil is light in color and has a delicious flavor. The potential markets for hazel oil are enormous.

Other important developments include the development of a processing machine that allows landowners to remove the involucre (husk) off the hazelnut shell. This machine was developed by the Southwest Badger RC&D Council and will be made available to hazelnut producers in southwest Wisconsin. This machine will allow hazelnut producers to husk hazels on-farm reducing transportation costs and creating the opportunity for direct sales.

Commercial Hazelnut Development Project

Final Report

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The Commercial Hazelnut Development Project

The Southwest Badger Resource Conservation and Development Council (RC&D) in cooperation with Mark Shepard (New Forest Farm) have successfully completed the first year of a project titled “Commercial Hazelnut Development Project”. The DATCP ADD program awarded Southwest Badger RC&D \$10,850.00 to complete the first two objectives of this project. These completed objectives are: 1) The establishment of the first commercial scale Hazelnut planting in Wisconsin and 2) The discovery of the actual establishment costs and analysis of said costs for a commercial-scale Hybrid Bush Hazelnut planting.

As commodity crop prices continue to decline and production costs soar, alternative crops must be integrated into traditional farms in order for them to remain profitable and sustainable. The mission of the Commercial Hazelnut Development Project is to provide farmers and agency personnel with the agronomic practices and economic data needed for successful establishment of commercial Hazelnut in Wisconsin. Constraints to the adoption of agroforestry practices such as Hazelnut production, result from the lack of reliable farm-level production data and proven establishment techniques. Through on-farm research, this project will provide the foundational information needed in order to make Hazelnut Wisconsin’s next cash crop industry.

Hazelnuts are a worldwide commodity, consumed primarily as a luxury food due to its limited supply. United States production of Hazelnut is approximately 20% of U.S. consumption and is less than 2% of world production. Hazelnut production in the United States has been limited to the Pacific Northwest for several reasons. One reason, is that the European Hazelnut (*Corylus avellana*), the nut of world trade, is a Mediterranean species requiring warm summers and mild winters. Another limiting factor is the incidence of Eastern Filbert Blight (EFB) in most of the United States. Eastern Filbert Blight is a disease that is fatal to European Hazelnut. The wild American Hazelnut (*Corylus americana*) and the wild Beaked Hazelnut (*Corylus cornuta*), natives to all regions of the country east of the Rocky Mountains, are functionally immune to EFB, but produce small crops of small nuts unsuitable for commercial use.

Through the breeding efforts of many amateurs and professionals alike, the size and market qualities of the European Hazelnut have been combined with the disease resistance and cold hardiness of the American Hazelnut. Without the efforts of all of these forward thinking plant breeders this project could not have taken place. In fact this project could not have occurred any sooner simply because the advances in plant breeding had not yet reached their current level.

In 1995, New Forest Farm began field trials of Hazelnut varieties to determine their suitability as crops in the upper midwest. Since then nearly a dozen varieties of Hazelnut have been planted, all of which claimed to be extremely productive and resistant to EFB. Of the original varieties trialed, only four have survived the presence of EFB, which exists at high levels in the area. Of the four that have survived EFB, two have languished... Skinner (from Oregon) and Grand Traverse (a variety bred in Michigan by plant breeder Cecil Ferris). Currently infected with EFB at New Forest Farm—yet still alive—one variety (the Gellatly Filazel) appears to have a healthy and vigorous bush. However, it is extremely susceptible to an unidentified type of bud mite which destroys the fruiting buds before they have an opportunity to produce nuts.

The only Hybrid Bush Hazelnuts that have thrived at New Forest Farm are the result of the breeding work of Phillip A. Rutter of Canton, Minnesota. Mr. Rutter has been breeding Hybrid Bush Hazelnuts for nearly thirty years and is the founder, president, and current CEO of the Badgersett Research Company. Badgersett Research is devoted to the development of highly productive plant material for use in “woody agriculture” cropping systems.

The Badgersett Hybrid Bush Hazelnut

Growing range & soils

Badgersett Hybrid Bush Hazelnuts are successfully grown from Northern Minnesota (USDA Hardiness Zone 3) to Nebraska City, Nebraska and from Fort Leavenworth, Kansas to upstate New York. They show a very wide adaptability to soil types from alkaline through slightly acid. According to research done by Badgersett Research, their Hazels do not do well when the Ph is below 4.7. Badgersett hazels have been successfully grown in sands, limestone ledge, blue clay, and most agricultural soils. The “ideal” soil for Badgersett Hazel is not known because of the newness of the crop.

Weed control

The Badgersett Hybrid bush Hazelnut is bred for survivability, early production, heavy crops, pest and disease resistance. The realities of farming make it such that despite the best of intentions woody crops, such as Hazelnut, it will get ignored at some time during their life. Most other woody crops such as blueberries or grapes would die if taken over by weeds. Badgersett hazels, although they no doubt would grow best with optimal care, survive and bear crops without any weed control whatsoever. Cultivation and mowing in the establishment year is all that is necessary for weed control. As the plants mature, they begin to shade out the weeds within the row. Mowing the alleys between the rows is sufficient to control weeds next to the plants.

As of yet, it is not known which herbicides are the most effective for use with Badgersett Hazelnuts.

Pests

Most woody crops would not have a marketable crop if insect pests weren't controlled in some way. This is not the case with Badgersett Hazels. Although there are several insect pests that live in association with Badgersett Hazels, they have never reached economically damaging thresholds at Badgersett Farm or any other location growing Badgersett Hazels. By growing Hazels in a manner that closely mimics their native ecosystem, pest populations are naturally balanced by their predators. Some pests are:

Leafroller- There are several species of leafroller (a leaf-eating caterpillar) that affect hazelnut. Pheromone traps & disruptors, Organic controls and insecticides are commercially available if a grower chooses to use them.

Nut Weevil- A weevil whose larval stage is spent in the nut. Nuts with weevils are hollow and can be removed from market nuts by floating them in water prior to storage. Commercial controls are available.

Bronze Birch Borer- There are several species of borer that lay their eggs in the stems of Hazelnut. The larvae eat the cambium and eventually girdle the stem. Since Badgersett Hazels are a multi-stemmed shrub, borer activity merely serves to prune the shrub and allow more sunlight to penetrate the shrub.

Diseases

Disease control in most woody crops is once again a costly and continuous affair. Badgersett Hazels are genetically selected to be resistant to disease. They can be successfully grown with no disease controlling sprays whatsoever.

Some diseases are:

Eastern Filbert Blight - EFB is the primary disease with economic consequences for Hazelnut production. Badgersett Hazels are either totally or functionally immune to EFB. Some Badgersett plants get EFB and co-exist with it for years with no ill effects. Other Badgersett plants get EFB in one or more stems then drop that stem. The effect is similar to borer damage.

Anthraxnose- Anthracnose is a fungus that colonizes the leaves of Hazelnuts after periods of prolonged humid weather. Although the leaves turn rust-colored and may appear unattractive, there seems

to be no apparent ill affects. Sulfur and Copper sprays are commercially available to control Anthracnose preventatively.

Irrigation

Badgersett Hazelnuts are successfully grown without irrigation in Nebraska with an annual rainfall of only 18". No research is available showing whether irrigation will increase yields or not.

During the establishment year, Badgersett Research recommends watering newly transplanted Hazels if they do not receive at least 1/2" of rainfall per week. During the project period, several hundred newly planted Hazels went three weeks without rain or irrigation. (see below)

Fertilizer

Very little formal research has been done to discover the optimal fertilization rates for Badgersett Hazelnuts. Some research has shown that yields increase with applications up to 300lbs of Nitrogen applied per acre. Experience has shown that they will do quite well with no added fertilizers once established. Currently (summer 2001) the most productive block of hazelnuts at Badgersett Research Farm have gone with no fertilizer for three years. They are showing no ill affects and are carrying a full crop.

It is not known what the economic thresholds are for fertilizer applications, especially for newly established plants.

Harvest

Badgersett Hybrid bush Hazels are all currently hand-harvested approximately a week before they are ripe. They are then stored in a humid location while the nuts cure. After curing they are dried and husked. Unlike apples or other fruit, Hazelnuts can be stripped from the bushes by hand rather rapidly since they are hard-shelled and will not bruise. A mechanical straddle harvester is the most likely device that will be harvesting bush Hazelnuts in the future. BEI Co. and Korvan Co., manufacturers of straddle-harvesters have both contributed to the development of the Hazelnut industry in the midwest and will continue to be involved as more growers become involved.

In Oregon, the ground beneath Hazelnut trees is kept completely bare and level at great expense. The nuts are allowed to ripen completely and fall to the ground. They are then blown into windrows and picked up using a vacuum or sweeper. This harvest method could be adapted for use with bush Hazels, however, the pest control, disease control and fertility benefits that come from growing Hazels in a grassland ecosystem would disappear and additional costs would be incurred.

The majority of the world Hazelnut supply is harvested by hand.

Coppice

In order to maintain plant vigor and to maximize nut bearing area on each plant, Badgersett Hybrid Bush Hazelnuts need to be periodically rejuvenated. The commonly used practice for this is coppicing. When the shrubs reach 10-12 feet in height and the new growth begins to slow down, the entire plant is mowed completely to the ground following the harvest. This can be done with a flail mower. On large plantings, a feller-buncher could possibly be used. Hazelnut wood is a potentially valuable biomass crop that can be sold for pulp, fuel, landscape mulch, edible mushroom substrate or other creative uses. The anti-cancer drug Taxol, found in Hazelnuts themselves, may possibly be extracted from the chips as well. Leaving the chips on the ground where they fall helps to build soil organic matter and conserve nutrients and moisture.

Establishment of Badgersett Hybrid Bush Hazelnuts

The project area at New Forest Farm is comprised of three, moderate to steep slopes with all aspects to the sun. In the spring of 2000, 10 foot wide strips were mouldboard plowed over the entire project area. These strips of plowed soil were then disked in order to make a fairly smooth planting bed. (Chisel plowing is not recommended since the unburied surface residue clogs the transplanter, slowing down the planting process) The plowed strips were arranged on the hillside in alternating patterns so that the rows of Hazels would alternate from 10ft apart to 15ft apart repeated throughout the area. This row pattern will allow for vehicle access between every other row as the plants mature.

The planting of the Hybrid Bush Hazels began as soon as the plants were ready from Badgersett Research Company. Unlike most forestry nursery trees, Badgersett Hazelnuts are grown in a greenhouse in small pots approximately 1" in diameter and 8" deep. These small pots are called "tubes" in the trade and the young plants are called "tubelings". Most forestry nursery stock isn't planted until it has grown in the nursery for one entire season and is planted the next spring as bare-root, dormant stock. Badgersett Hybrids are most commonly planted when only two to three months old and are planted in the summer and early fall while they are fully leafed out and actively growing. Tree transplanting machinery that plants bare-root nursery stock does not work with these tubelings. Several vegetable and tobacco transplanters have been trialed at New Forest Farm over the years and the one that works is a D.R.Ellis transplanter. It works adequately without modification yet its performance is improved with some minor modifications to the machine.

In order to obtain as much information as possible from the project, several experimental techniques were used in addition to the usual ones. The first 2000 hazels planted, were overwintered at Badgersett Research using a new (for them) storage technique. Thereafter, the tubelings used were identical to those that any other customer would purchase.

Planting occurred over the course of eight weeks in the summer of 2000 and three weeks in summer of 2001. The demands of the farm would not allow planting to occur all at once. Immediately prior to planting, the soil was disked one final time and rows marked with spray paint or barn lime. A planting crew was hired which consisted of two people on the transplanter and one driving the tractor. It is possible for one person to ride the transplanter and one to drive the tractor, however, the entire operation is much more efficient and less frantic for the person on the transplanter if there are two of them. As the tractor driver marked the rows, the transplanter crew carefully removed the Hazels from the tubes and placed them in the plant tray of the transplanter. The Transplanter tank was filled with water and fertilizer. The fertilizer used was Dramm "Liquid Fish", a fish and kelp emulsion. One half gallon of liquid fish was used per 50 gallons of water. "Iron Roots" brand myco-inoculant was added to the tank at the rate of 1tablespoon per 50 gallons of water. This introduced spores of beneficial root fungi to the seedlings as they were planted.

Once the transplanter made a pass down the row, the entire crew would get off the machinery and go back over the row to straighten plants and make sure that the root ball of the plant was completely covered with soil. Although this was a time consuming step, it was essential. If any of the tubeling's potting medium is exposed, it will act as a wick and will draw moisture from the plant's roots killing it in a matter of days.

In the beginning of the project, Hazels were planted with 6ft spaces between plants. This is the most common spacing among current growers. At 6 ft spacing between plants and rows as described above, there are approximately 873 plants per acre. Accordingly, the project area encompassed approximately 12 acres. Since the information on optimal plant spacing does not exist, the decision was made to test different plant spacings on this project. Approximately half way through the project area, plant spacing was changed to 3ft between plants. For the final 20% of the planting (planted in 2001) plant spacing was changed to 2ft between plants. Extra plant material was provided by Badgersett Research and consisted of highly experimental breeding stock and is not included in the cost analysis of this project. The establishment cost data is based upon plant spacing of 6ft between plants.

Since the early summer of 2000 was very wet, no supplemental watering was done. Since no data exists on herbicides suitable for hybrid bush hazelnuts, none were used. When weather and soil conditions were suitable, weed control was accomplished using a Farmall-C with cultivators. Any corn or tobacco cultivating equipment will suffice. Weeds grew up between the plants within the row. Hazelnuts are very competitive with weeds and can survive quite well even when completely taken over by weeds.

Once the rains stopped, two weeks went by when the temperatures soared. The muddy soil baked hard. One planting occurred during the first week of no rain and one occurred during the second week of no rain. When the third week of no rain occurred, the two “rainless” plantings were checked to see if they needed supplemental water. When checked, both plantings had set dormant buds and dropped their leaves. When regular rain resumed a week later, both plantings began growing again and by the end of summer were indistinguishable from any of the plants that had not dropped their leaves.

In the early summer of 2001, three final plantings were made and the first regular mowing took place. In the early years, it appears that the alleys between Hazelnut rows will need to be mowed between four and five times during a season. This allows more light to penetrate through the in-row weeds to the young Hazels and reduces root competition for nutrients and water.

Mowing and fertilizing will be the only maintenance done to the Hazelnut field until the bushes are coppiced.

Cost of Establishment

Table 1 (attached) is the Establishment Cost Summary for the planting of 10,478 Badgersett Hybrid Bush Hazelnuts. It describes the actual costs incurred by New Forest Farm during the Commercial Hazelnut Development Project year during the month in which it occurred.

Of note to the potential grower: Many farmers don't include the cost of their own time. For this project I did so primarily to give an accurate picture of the true costs of establishment. If a farmer wishes to hire a contractor to plant Hazelnuts, this figure will need to be included. I chose \$25.00 per hour somewhat arbitrarily. It is probably safe to assume that a Hazelnut planting contractor would charge that much for his/her time and overhead. For farmers planting their own Hazelnuts, the dollar amount “Labor/Self” can be ignored, since it is not a cash expenditure.

Likewise with mileage. I did not have to pay \$0.31 per mile in cash at the time that I used my vehicle. This figure is included to account for the overhead cost of using my vehicle. If I hadn't used my own vehicle, I would have had to pay UPS or other shipping charges for the plants to be delivered to the farm. This would have resulted in plants that had been handled several more times and an additional cost of 10%. This additional shipping cost would have totaled \$3,405.35 for this project. This is considerably more than the \$1,015.56 personal mileage cost. If the personal mileage cost is added to the personal labor cost of going to pick up plants in person (77hrs X \$25.00 = \$1925.00) the total cost for me to pick up the plants totaled only \$2,940.56. Picking up the plants in person helped to avoid an actual cash cost, saved the plants additional handling and was \$464.79 cheaper than UPS.

Table 1 shows that most of the time involved in establishing a commercial scale Hazelnut field was concentrated primarily in May, June and July. May was primarily field preparation while June and July were mainly planting. Once the Hazelnuts were planted, the labor involved in their upkeep went way down. Personal hours in the wintertime, were spent walking through the Hazels observing whatever was noticeable.

The information from Table 1 is summarized below:

Custom Plowing	\$	300.00	
Labor (self) 268.3 hrs	\$	6,706.25	
Hired Labor 287.5 hrs	\$	3,115.00	
Travel (getting plants)	\$	1,015.56	
Tractor Fuel	\$	544.04	
Fertilizer & supplies	\$	142.99	
Hazelnut Plants		<u>\$34,053.50</u>	
Project cost =		\$46,466.53	

Table 2 (attached) takes its information from Table 1 and categorizes the various different expenses and is summarized below:

Project Site = 12 Acres			
Site preparation costs	\$1,347.50		\$112.30/acre
Planting costs	\$4,725.00		\$393.75/acre
1 st Year maintenance costs	\$1,660.00		\$138.33/acre
Hired Labor cost	\$3,035.00		\$137.95/acre

Costs not included: Property tax, mortgage, insurance, interest.

Table 3 (attached) is a table showing the potential cash-flow from a one acre Badgersett Hybrid Bush Hazelnut planting. It is constructed using very sparse data. Since the commercial growing of Badgersett Hybrids is so new, there is very little information to work with. The yield figures on Table 3 are derived from the Badgersett Research Corporation's research database, which they willingly provided for this project. Table 3 lists the several assumptions made for the cash-flow projection.

For one, Badgersett Hybrids are all seedlings and are all genetically unique. Therefore they will be somewhat variable in growth, shape, yields, nut size etc. Some have yielded as many as 9 lbs per plant. Most yield much less. For this projection we chose a mature yield of 2 lbs per plant which is a very conservative figure.

The terminal market price in Portland, Oregon for in-shell processing hazels (which were last available on Jan 15, 2001) was \$0.88/lb. Since 1999, the price has fluctuated from a low of \$0.38/lb to a high of over a dollar. In order once again to be very conservative in our estimates, we used \$0.44/lb as a market price. This was only 50% of this year's market price, but low enough to demonstrate what could happen in a year of low prices.

Using the above figures, table 3 concludes that it is very likely that a grower can expect to gross on average \$462.69 per acre for processing grade hazels at commodity market prices. At the most current prices, the same acre of Hazels would gross \$925.38 per acre. What lies hidden in these numbers is the fact that with establishment and later with coppicing, out of 24 years there are 7 years with no yields at all.

Direct retail sales and value added products will make the return per acre even higher. Retail prices in 2000 ranged from \$2.00/lb to \$4.00/lb. Certified Organic Hazelnuts retailed in the January of 2001 for \$7.00/lb

Cash Flow Projection

The following table uses numbers from table one, two and three to project potential cash flow for a one acre Badgersett Hybrid Bush Hazelnut planting. Actual establishment costs may vary and some costs (such as harvest costs) are not known at this time. The table below assumes a post-harvest cost of \$0.10/lb

Year	Operating Cost	Income (Wholesale)	Cumulative Net Cash Flow
1	\$3,872.21	0	-\$3,872.21
2	\$138.33	0	-\$4,010.54
3	\$138.33	0	-\$4,148.87
4	\$138.33	0	-\$4,287.20
5	\$155.79	\$153.64	-\$4,289.35
6	\$225.63	\$384.12	-\$4,130.86
7	\$260.55	\$537.76	-\$3,853.65
8	\$278.01	\$614.59	-\$3,517.07
9	\$312.93	\$768.24	-\$3,061.76
10	\$312.93	\$768.24	-\$2,606.45
11	\$312.93	\$768.24	-\$2,151.14
12	\$138.33	0	-\$2,289.47
13	\$138.33	0	-\$2,427.80
14	\$225.63	\$384.12	-\$2,269.31
15	\$260.55	\$537.76	-\$1,992.10
16	\$312.93	\$768.24	-\$1,536.79
17	\$312.93	\$768.24	-\$1,081.48
18	\$312.93	\$768.24	-\$626.17
19	\$312.93	\$768.24	-\$170.86
20	\$312.93	\$768.24	\$284.45
21	\$312.93	\$768.24	\$739.76
22	\$312.93	\$768.24	\$1,195.07
23	\$312.93	\$768.24	\$1,650.38
24	138.33	0	\$1,512.05

Conclusion

The results of The Commercial Hazelnut Development Project demonstrate that Hazelnuts have potential as a low-input, low-maintenance crop in Wisconsin. The results from this project indicate that establishment costs for Badgersett Hybrid Bush Hazelnut are approximately \$3,872.21 per acre with annual income possibilities of an average of \$462.69/year if the nuts are sold as low-grade, processing nuts. At these prices and yields, Hazelnut is obviously not a get-rich-quick crop. It is, however, an easy to grow crop with large, dependable existing international markets.

As the above tables show, there are several key points that will make Hazelnut production more profitable. One is yield. More research needs to be done to determine the optimum fertility for hazelnut production. Increase in yield of just a few ounces per plant can make a significant difference in return. Another factor is the length of time between planting and full production. It is possible that certain tree growth enhancing products (such as tube shelters, mats, mulch, growth hormones) can bring a Hazelnut field into production sooner. Research needs to be done on these products to determine their cost-effectiveness. Weed control during establishment also makes a difference in how fast a Hybrid Hazelnut bush comes into production. Weed control may also affect total yield per plant. Herbicides for Badgersett Hybrid Bush Hazels, and their cost effectiveness are not known and more research needs to be done.

Probably the most significant factor in increasing the return to the grower for Hybrid Hazelnut is to maximize the amount of the crop sold at retail prices and/or at value-added prices. The relative scarcity of current Hazelnut supplies creates an ideal opportunity for the development of new products. Production and marketing of these new products can be an opportunity for rural job creation. An example of one possibility would be the manufacture of hazelnut oil. The oil sells at a high retail price (\$6.00 for 8oz) and can be used in cosmetics, skin care products, nutraceuticals, beverages (like soy milk) and can be used for making a plant-based cheese. The high protein meal left over from oil pressing can be used to make snack foods, baked goods, candies, flavorings or even feed for livestock. The nut-shells can be ground, graded and used as industrial abrasives, additives to wood glues, or burned for heat and electrical generation.

Hybrid bush Hazelnut production is an economically viable option for farms in Wisconsin. The industry is in its infancy and has a promising future.