(continued from page 1)
basic or applied research, innovative technology transfer, production promotion, new product development or marketing techniques, and significant service to the Walnut Council. If you know a deserving individual, agency, or organization that you would like to nominate, contact James E. Jones, Chairman of Walnut Achievement Award Committee (see front cover) for nomination forms. Nomination forms will be due on or before June 24, 1988.

After the Business meeting, we will board buses for lunch and a field trip in the Dodgeville area to visit a natural stand after completion of a timber stand improvement plan, a 10-year-old walnut plantation, the J. J. Rule walnut demonstration forest, and an adjacent managed natural walnut stand. That evening the Annual Banquet will be served at the Blackhawk Lake Recreation Area.

On Tuesday, July 26th, we will board the buses early for an all day field trip into southwestern Wisconsin to visit two sawmills before having an early lunch at the Tower Hills State Park. From there we will visit another walnut plantation and a manufacturing plant for woodcraft products. The meeting will adjourn at the conclusion of the field trip late in the afternoon.

The next issue of the *Walnut Council Bulletin* will contain the necessary preregistration forms and more detailed information about the program. In the interim, plan to make room reservations at the Karakahl Inn. Ask for Donna Hicks or Colleen Cox at 608/437-5545. Group room rates, if received by June 23, are $36.00 plus tax for a single and $42.00 plus tax for a double.

1987 Supporting Members of the Council

The Walnut Council wishes to express our gratitude to the following supporting members who contributed $50.00 to help support the activities of the Walnut Council. Their extra effort helps the Walnut Council to continue growing and meeting the needs of our members.

Lillian L. Greenwald — Bristol, VA
Dr. and Mrs. Sydney Eisen — Evanston, IN
Robert E. Hollowell, Jr. — Indianapolis, IN
Sigurd G. Peterson — LaPorte, IN
Hugh B. Pence — Lafayette, IN
Frank Purcell Walnut Lumber Co. — Kansas City, KS
Raymond Neiswender — Topeka, KS
E. E. Freeman, Jr. — Winchester, KY
Max Leach — Campbellsville, KY
Ben Petree — Silver Spring, MD
Robert Hahn — St. Paul, MN
Karl Wolf — Webster Groves, MO
Frank Paxton, Jr. — Kansas City, MO
Mr. and Mrs. C. Stricker — St. James, MO
Peter Mosling — Pickett, WI

Future Meetings

DATE	LOCATION	CONTACT
July 24-26, 1988	Mount Horeb, Wisconsin	Jim Widder & David Ladd
August 6-9, 1989	Carbondale, Illinois	John Phelps
August, 1990	Southern Indiana	Bob Burke

Site-Improving Intercrops for Black Walnut

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Introduction

Broadly defined, intercropping of black walnut (*Juglans nigra* L.) refers to the production of one or more additional crops for food and/or fiber during all or part of the walnut rotation. Intercropping of walnut has been proposed for two main reasons: (1) to increase growth and/or quality of the walnut trees or (2) to provide an early financial return to help offset the costs associated with establishing the walnut plantation. Although a wide range of intercropping regimes can be proposed, few have been examined for their economic benefits or effects on walnut growth and quality. Needless to say, long-term walnut growth and quality should not be jeopardized for small, early economic returns from intercrops.

Intercropping is most successful when the two crops demand and use resources such as soil moisture, nutrients, or light at different times. For example, the amount of soil nitrogen could be increased by selecting legumes that readily release fixed-nitrogen or that can be incorporated into the soil when the walnut nitrogen demand is the highest. One disadvantage of intercropping walnut is that frequently fewer trees per acre are planted to allow for growth of the other crop; thus, there will be fewer walnut trees from which to select the potential crop trees. Ideally, the intercrop should produce enough added value in increased walnut growth or quality to offset the losses from reduced opportunities for selection gains through thinning.

Walnut intercrops fall into two main classes—woody nurse crops or cover crops. Woody nurse crops consist of other trees or shrubs interplanted with walnut to improve tree growth or quality during the juvenile growth stage. Cover crops, on the other hand, are forbs or grasses planted primarily to improve the physical properties of the soil, improve nutrient availability, and suppress growth of other understory vegetation. In general, we know more about intercropping woody nurse crops, especially nitrogen-fixing trees and shrubs, than we do about using cover crops in walnut plantations.

Nitrogen-Fixing Woody Nurse Crops

Nitrogen-fixing trees and shrubs fall into two broad categories. The leguminous trees and shrubs make up the largest category and are nodulated by the bacterium *Rhizobium*, which is the same bacteria that produces nodules on crops like garden peas, beans, and soybeans. Actinorhizal trees and shrubs make up the other category and are nodulated by the actinomycete *Frankia* (Torrey 1978).

Table 1. Sixth year height and crown area for walnut and the interplanted nitrogen-fixing and non-nitrogen-fixing nurse crops on a bottomland site in central Illinois.

Interplanted species	Height		Crown area	
	Black walnut	Nurse crop	Black walnut	Nurse crop
	feet		square feet	
NITROGEN-FIXING				
European alder	8.8 a	13.9 a	46 a	51 a
Russian olive	8.1 ab	10.1 b	44 a	44 a
Autumn olive	6.9 ab	7.3 c	36 a	33 ab
Siberian peashrub	8.1 ab	3.3 f	42 a	2 d
NON-NITROGEN FIXING				
Amur honeysuckle	7.2 ab	7.0 cd	38 a	47 a
Ginnala maple	6.8 ab	5.3 de	35 a	23 bc
Scotch pine	6.3 b	3.8 ef	28 a	8 cd
Close-spaced walnut	6.8 ab	———	32 a	———

Means within the same column followed by the same letter are not significantly different from each other at the 5-percent level.

There are six leguminous trees or shrubs currently available from one or more state nurseries within the natural range of walnut. These include black locust, Siberian peashrub, bristly locust, shrub lespedeza, honey locust, and redbud. Of these, only black locust and Siberian peashrub have been tested in walnut interplantings. Black locust will stimulate walnut growth; however, black locust rapidly overtops and suppresses the growth of walnut (Schlesinger and Williams 1984). Black locust, if coppiced or otherwise controlled, could be used early in the walnut rotation and then harvested for fenceposts or firewood as part of a precommercial thinning in the planting. Siberian peashrub, a leguminous shrub used in shelterbelts in the northern part of the walnut range, grows much slower than walnut and has not stimulated walnut growth in a planting in central Illinois (table 1).

Bristly locust and shrub lespedeza can both grow on a wide variety of sites and are excellent nitrogen fixers; however, neither has been tested in walnut interplantings because their mature heights are too short to act as trainers for the walnut trees. Honey locust and redbud have not been used in our interplantings trials because they are not nodulated and presumably do not fix atmospheric nitrogen (Halliday 1984).

Actinorhizal plants currently available from state tree nurseries include European (black) alder, autumn olive, and Russian olive. All three are being tested together in a walnut interplanting in central Illinois (table 1). European alder has been shown to stimulate the tree growth in a few walnut interplantings (Schlesinger and Williams 1984; Van Sambeek *et al.* 1985). On moderately to poorly drained soils, European alder is frequently killed early in the rotation in response to juglone produced by the walnut trees (Rietveld *et al.* 1983).

Autumn olive will stimulate the growth of walnut on all but the best walnut sites (Schlesinger and Williams 1984). The increased foliar nitrogen content of walnut interplanted with autumn olive suggests that atmospheric nitrogen fixed by autumn olive is readily made available to the walnut trees (Ponder 1983). Unfortunately, the "Cardinal" strain of autumn olive originally selected for planting in the United States is a prolific seed bearer and is widely spread to unmowed areas by birds that use the berries for food. As a result, several states have or are considering a ban on the planting of autumn olive. In addition, in some areas, autumn olive periodically suffers extensive dieback in response to climatic stress and/or an identified stem pathogen (Van Sambeek *et al.* 1985).

Russian olive is an actinorhizal shrub similar to autumn olive in crown form and is frequently used in wildlife plantings in the northern part of the walnut range. Growth rate appears to be compatible with walnut (table 1). Branch dieback on older trees due to Phomopsis canker will limit the potential usefulness of Russian olive in the southern part of the walnut range.

Non-Nitrogen-Fixing Woody Nurse Crops

Few non-nitrogen-fixing trees have been evaluated as possible candidates for intercropping with walnut. White pine is promising because it can be harvested early in the walnut rotation for Christmas trees or allowed to grow and be harvested later as pulpwood (Camp 1986). Because white ash, sugar maple, and red oak have wide-spreading branches with dense foliage and growth rates similar to walnut, these high value hardwoods are also occasionally recommended.

A relatively large number of non-nitrogen-fixing shrubs are currently available from state nurseries for wildlife plantings; however, most of these shrubs have not been tested in experimental interplantings. Amur honeysuckle and ginnala maple, two shrubs with growth rates and crown forms similar to autumn olive, are being tested in an interplanting in central Illinois (table 1). Both species were introduced into the United States and seedling availability may become a problem as state nurseries

Black Walnut
Information Hotline
618/453-2318

Call this number to find answers to questions or problems concerning planting, growing, or selling black walnut trees.

begin placing more emphasis on production of native shrubs over exotic shrubs.

Benefits From Woody Nurse Crops

Because forest soils are characteristically low in available nitrogen, researchers initially assumed that the primary benefit of interplanting nitrogen-fixing nurse crops with walnut would be the addition of nitrogen to the site and increases in available soil nitrogen have been found in some interplantings (Funk *et al.* 1979). Several studies have shown that improved walnut growth is highly correlated with increases in walnut foliar nitrogen concentration (von Althen 1985, Van Sambeek *et al.* 1985). Other benefits including improving the physical properties of the soil, reducing the understory competition, providing wind protection, moderating soil and air temperatures, and disrupting the life cycle of several walnut pests have also been observed (Schlesinger and Williams 1984).

Soil properties in successful interplantings are usually more similar to those found in productive timber stands than in cultivated or old field sites. Forest soils typically have organic matter contents between 3 and 4 percent compared to 2 percent for agricultural soils. Small increases in organic matter content remarkably augment a soils capacity to promote plant growth by decreasing the leaching of soil nitrogen, by increasing the water-holding capacity, and by increasing soil porosity and tilth (Brady 1974). Because most interplantings are not annually cultivated, these soils will more likely develop a higher organic matter content which can lead to improved long-term growth of walnut.

Reduced understory competition, especially from grasses, may also be very important (figure 1.). By the time crown closure in pure walnut stands is sufficient to suppress the understory vegetation, significant reductions in walnut growth will be occurring from between tree competition (Schlesinger, in press). Interplanting woody nurse crops can raise the total crown cover sufficiently to suppress the understory vegetation while minimizing the between tree competition that would normally occur in pure stands. In addition, the increased shading will help moderate soil temperature extremes and reduce the evapotranspiration rates. Overall, woody species with spreading crowns have tended to increase walnut growth more than tall, upright species (table 1).

Figure 1. Herbaceous vegetation has been shaded out beneath this 9-year-old black walnut planting interplanted with autumn olive.

Herbaceous Cover Crops

An alternative to intercropping with trees or shrubs to control the understory vegetation is underplanting with compatible ground covers or cover crops. Walnut is well suited for underplanting with shade-tolerant ground covers because of walnut's short growing season, sparse foliage, and deep taproot. Several multicropping systems (a series of intercrops) have been proposed that use winter wheat, soybeans, milo, or fescue between widely spaced rows of walnut managed for timber and nut production (Kurtz *et al.* 1984). Close spacing within rows still allows for some selection gains when thinning. Winter wheat is an excellent intercrop because its vegetative growth occurs while the walnuts are still dormant. Soybeans and milo are less attractive because both will compete with walnut for the available soil water and nutrients during the dry part of the growing season (figure 2).

Based on recent research results, we may want to proceed cautiously with intercropping with grasses like tall fescue and smooth bromegrass. In several walnut plantings with early acceptable tree growth, annual height growth has declined to unacceptable levels following establishment of a grass sod (Schlesinger and Van Sambeek 1986). Removal of the grass sod by annual cultivation or herbicide application frequently increases walnut growth to acceptable levels (Bocoum 1987, Miller *et al.* 1987). Other researchers have also advised against managing walnut trees with fescue (Holt and Voeller 1975, Todhunter and Beineke 1979, Roth and Mitchell 1982).

Recent research has shown that leachates from tall fescue sod will slow the growth of potted walnut seedlings (Rink and Van Sambeek 1985). Peters and Luu (1985) have shown that fescue leachates contain a number of short-chain organic acids that can inhibit plant growth.

Have You Paid Your 1988 Dues?

In January, our Executive Director Larry Frye sent a letter to all members of the Walnut Council asking for your support by paying your 1988 dues and helping to recruit new members. Check your mailing label. It should indicate through what date your dues are paid and your membership category (LM = Life Member, RM = Regular Member, YM = Student Member, and FM = State Forestry Member). If you have not paid your 1988 dues, please do so using the application for membership on the last page of the *Walnut Council Bulletin*. If you find any errors on your mailing label, please bring them to the attention of Larry Frye. We want everyone to continue receiving the *Walnut Council Bulletin* and all other mailings.

Figure 2. Soybeans growing between widely spaced rows of newly planted black walnut seedlings on a bottomland site in southern Illinois.

Because soil-borne organic acids are rapidly decomposed by soil microorganisms (Vaughn *et al.* 1983), these acids must be produced continuously to inhibit plant growth. The rapid restoration of walnut leaf color observed after removing fescue by summer cultivation suggests that growth of walnut trees may also be inhibited by fescue-produced organic acids.

Intercropping forage legumes between rows of walnut can stimulate walnut seedling and sapling height growth (Van Sambeek and Rietveld 1982, Van Sambeek *et al.* 1987). Interplanting hairy vetch, an annual cool-season legume, in combination with within row chemical weed control will stimulate walnut growth during the establishment phase (figure 3). Hairy vetch has also been shown to stimulate the growth of pole-sized walnuts (Schlesinger and Van Sambeek 1986, Bocoum 1987). Crownvetch, a cool-season perennial legume, and sericea lespedeza, a warm-season perennial legume, will also stimulate growth of established walnut seedlings (figure 4).

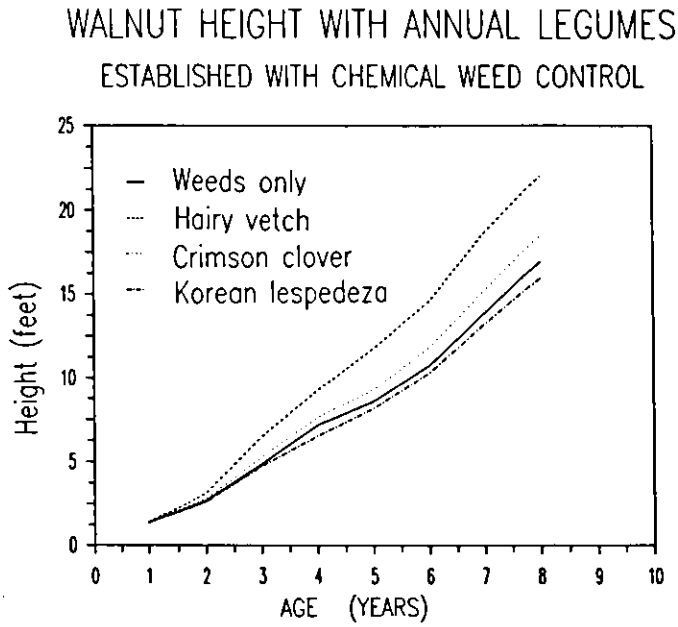

Figure 3. Height of walnut through eighth growing season when intercropped with and without annual legumes. Chemical weed control around individual seedlings was used for the first three years.

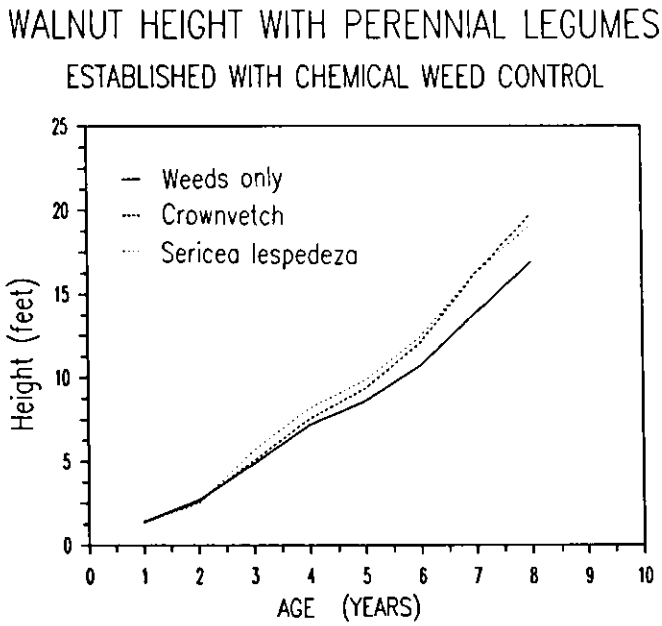

Figure 4. Height of walnut through eighth growing season when intercropped with and without perennial legumes. Chemical weed control around individual seedlings was used for the first three years.

For long-term maintenance of forages under closely spaced walnut trees, semi-shade to shade tolerant legumes will need to be established. Potentially legumes like cicer milkvetch, crownvetch, flatpea, birdsfoot trefoil, and several of the lespedezas could be used in forest plantings because they are somewhat shade-tolerant, persistent, and either suppress other weeds or produce palatable forages (figure 5). Forage legumes like alfalfa, sweet clover, and red clover have little or no shade-tolerance and would probably not persist after plantation establishment.

Benefits From Cover Crops

A common cause of growth stagnation in young walnut plantations is competition for available nitrogen (von

New Life Members Recognized

Since our last announcement, the Walnut Council has increased the number of life members from 15 to 21. The Walnut Council wishes to recognize new life members who are also helping the Walnut Council to continue growing and meeting the needs of our members.

George T. Trial — Columbia, MO
James H. Lee — Memphis, TN
Ralph R. Obenchain — Woodstock, IL
Tom Cox — Peoria, IL
Bonnie Ennis — East Peoria, IL
Lillian L. Greenwald — Bristol, VA

Figure 5. Eight-year-old black walnut underplanted with crownvetch. Notice the large number of branches on the trees and the nearly weed-free, mulched soil surface under this planting.

Althen 1985). Besides suppressing growth of weeds (Van Sambeek and Rietveld 1982), planting legumes will also increase soil nitrate nitrogen levels making more nitrogen available for uptake by the trees (White *et al.* 1981). Apparently, the benefits from increased soil nitrogen, increased soil organic matter content, and reduced incidence and severity of foliar pests offset the impact of the increased soil water and nutrient uptake associated with the increased biomass produced by the planted legumes. Harvesting intercropped legumes for hay will probably result in little or no increase in soil nitrogen or organic matter and the benefits derived from mulching the soil surface would also be lost.

The heavy mulches produced by unharvested ground covers aid in the adsorption and retention of soil moisture and can significantly delay budburst and flowering of walnut in the spring—an important consideration for a tree species with flowers killed by late spring frosts (Wolstenholme 1970). When managing for timber and nuts, leguminous ground covers have been shown to stimulate earlier walnut fruiting and increased numbers of nuts per tree in young plantations (table 2).

Table 2. Percentage of trees bearing through the eighth growing season and total number of nuts per tree when intercropped with legumes on an upland planting in southern Illinois.

Intercropped legume	Trees bearing	Nuts per tree
	(%)	(#)
Crownvetch	63 a	33 a
Hairy vetch	43 ab	16 ab
Sericea lespedeza	31 bc	14 ab
Crimson clover	27 bc	12 b
Korean lespedeza	16 c	4 b
None (weeds only)	20 c	4 b

Means within columns followed by the same letter are not significantly different from each other at the 5-percent level.

Conclusions

Research data indicate that intercropping with nitrogen-fixing trees and shrubs can significantly improve the early growth of walnut. Benefits are currently ascribed to release of fixed-nitrogen and suppression of competing understory vegetation, especially grasses. Intercropping semi-shade tolerant legumes as a compatible ground cover is a promising alternative to using nitrogen-fixing trees and shrubs.

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(continued on page 11)

"SUCCESSFUL BLACK WALNUT MANAGEMENT REQUIRES LONG-TERM COMMITMENT" by Richard C. Schlesinger and Barbara C. Weber in Northern Journal of Applied Forestry (1987) 4:20-23.

Authors point out that growing walnut requires a long-term commitment if you plan to produce high quality logs under short rotation forestry. Intensive management requiring continuing, periodic silvicultural treatments, i.e. weed control, vegetation management, pruning, and thinning, will be necessary for at least 40 to 50 years. First consideration should be given to pruning and release of walnut trees in natural stands to shorten this time frame. Plantation culture will require additional investments, i.e. establishment, weed control, and early vegetation management, to achieve satisfactory growth and to produce a quality product. Authors emphasize that the decision to grow walnut must be based on a long-term commitment and that it is not a one-time investment.

UNDER THE WALNUT TREE

The recipes selected for this column are taken from a variety of sources and demonstrate how versatile black walnut nutmeats can be. If you have a favorite recipe calling for walnuts, especially black walnut nutmeats, please send it to the *Bulletin* Editor (address on front cover), so it can be included in a future issue.

Colonial Nut Bread

2/3 cup sugar
1 lightly beaten egg
2-1/2 cups flour
1/2 teaspoon salt
1 cup chopped black walnut nutmeats
1 cup raisins
2-1/2 teaspoons baking powder
1 cup sweet milk

Beat egg and gradually add sugar. Sift together flour, baking powder, and salt. Add the dry ingredients and sweet milk alternately to egg mixture. Stir in raisins and chopped nutmeats. Pour in a buttered loaf pan and let stand for 60 minutes. Bake at 350°F for 50 minutes.

[Reprinted from the Michigan Nut Growers Association *The Nutjar—A Cookbook*]

Black Walnut Pudding

4 eggs, separated
1 cup zwieback crumbs
1 cup chopped black walnut nutmeats
2/3 cup powdered sugar
1 teaspoon vanilla
1/2 cup heavy cream, whipped

Beat egg yolks slightly and combine with zwieback crumbs, chopped black walnut nutmeats, sugar, and vanilla. In separate bowl, beat egg whites until stiff. Gently fold beaten egg whites into nutmeat mixture. Pile into a buttered shallow casserole. Bake in 350°F oven 20 to 25 minutes. Let stand overnight before serving. Excellent with Zuppa da Pesce, bouillabaisse, or fish stew.

[Reprinted from the *New Casserole Cookery* by Marian Tracy.]

Rocky Road Fudge

20 large marshmallows
6 oz. semi-sweet chocolate
1/2 cup butter
2 cups sugar
2/3 cup evaporated milk
1 cup broken black walnut nutmeats
1 teaspoon vanilla

Cut 10 large marshmallows into quarters, spread on a cookie sheet, and freeze until firm. Break up chocolate and place with butter in large mixing bowl. In heavy sauce pan, combine sugar, 10 marshmallows, and milk. Bring to boil over medium heat and continue boiling for 5 minutes, stirring constantly. Pour hot mixture over chocolate and butter, stirring mixture until it is well blended and starts to thicken. Add chopped black walnut nutmeats, vanilla, and frozen marshmallow quarters. Pour into lightly greased 9-inch pan. Chill until firm. Cut into squares and store covered.

[Adapted from recipe in *Feed My Lambs* cookbook edited by Ruth Howard, Milbank, South Dakota.]

Chewy Black Walnut Squares

1 egg, unbeaten
1 cup brown sugar, packed
1 teaspoon vanilla
1/2 cup sifted all-purpose flour
1/4 teaspoon baking soda
1/4 teaspoon salt
1/2 to 1 cup chopped black walnut nutmeats

Combine egg, brown sugar, and vanilla. Quickly stir in flour, baking soda, and salt. Add chopped black walnut nutmeats. Spread in a greased 8-inch square pan. Bake at 350°F for 18 to 20 minutes. Be sure not to overbake: cookies will be soft in center when taken from oven. Cool in pan; cut into sixteen 2-inch squares.

[Adapted from recipe in June/July 1986 Issue of *Sun-Diamond Grower*.]

Site Improving Intercrops article

(continued from page 6)

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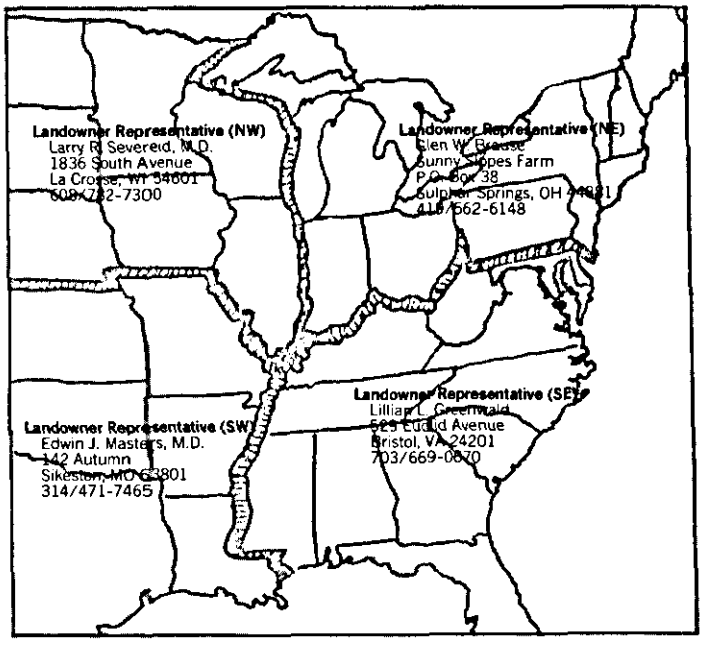
WALNUT COUNCIL BULLETIN

GROW and USE WALNUT PRODUCTS

Volume 15, Number 1 **Winter 1988**



1988 Annual Meeting to be in Wisconsin

The 1988 Annual Walnut Council Meeting has been scheduled for July 24 to July 26 at the Karakahl Inn in Mount Horeb, Wisconsin according to the program co-chairmen Jim Widder and David Ladd. Mount Horeb is approximately 20 miles west of Madison, Wisconsin. This year's theme will be "Walnut Naturally in Wisconsin." This meeting will be a must for those interested in black walnut natural stand management and lumber utilization.

On Sunday, July 24th, the Walnut Council Executive Board will meet all afternoon with meeting registration beginning in late afternoon. Plan to be at the meeting by 6:30 p.m. to meet with your Landowner Representative for a short meeting followed by the Landowner's Show and Tell. Now is the time to begin planning your slide presentation (15 to 20 minutes long) for this interesting and enlightening session. Please contact Larry Severeid (see map at bottom left) and let him or his secretary know that you are preparing a presentation.

On Monday, July 25th, the meeting will begin early with welcomes and several technical presentations. This will be followed by the Annual Business meeting. One of the highlights of the business meeting is presentation of the Walnut Achievement Award. This award is given for achievements in black walnut related activities including

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