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Green Lands

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Green Lands

Volume 15 Number 3

Our Cover — The Annual Interagency Evaluation Tour is one of West Virginia's best opportunities to show off its leadership in mining reclamation technology. Dippel and Dippel Coal Co., shown on our Fall cover, is one of many Association members whose work makes the tour what it is. For more of the same, see page 9.

Green Lands is a quarterly publication of the West Virginia Mining and Reclamation Association with offices at 1624 Kanawha Boulevard East, Charleston, West Virginia 25311 Telephone ((304) 346-5318

Editor
R. Daniel Miller

Business
Mary Ann Steele

Governor fills top DoE posts

Governor Arch Moore has announced appointments to fill the top level positions in the new West Virginia Department of Energy.

Ken Faerber, who has served as Acting Commissioner of the Department since July, will continue in that post, pending resolution of OSM objections to his appointment.

The federal agency has held that Faerber's ownership in coal companies, and in a reclamation company that does contract work for the State, constitutes a conflict of interest. OSM imposed a deadline of ninety days for the commissioner to divest his mining and reclamation interests, or resign his government post. Faerber has indicated that he will make every attempt to sell his interests in those companies.

The Governor has appointed Everett C. White of Huntington as Administrative Assistant in the Office of the Commissioner. White is a former employee of the Chafin Coal Co. where he served in several capacities.

The Division Director of the Mines and Minerals Division will be Thomas V. Reishman of Poca. Reishman is a former Director of the West Virginia Coal Development Authority.

Also within the Mines and Minerals Division, Richard A. Casdorph of Charleston has been appointed Deputy Director for Permits. Casdorph has been with the Department of Natural Resources for 20 years, most recently as Manager of the Special Reclamation Program.

Jame E. "Pete" Pitsenbarger of Elkview is the Deputy Director for Inspection and Enforcement. He is a 17 year veteran of the DNR, including the last eight years as Chief of the Division of Reclamation.

Barton B. Lay of Madison was appointed Deputy Director of Health, Safety, and Training. He was Deputy Director of the Department of Mines from 1980-1985, and most recently served as Director of the Department.

Three appointments were made within the Oil and Gas Division. The Division Director is John H. Johnston of Charleston, a former partner with an engineering consulting firm.

The Deputy Director for Permits is Margaret Hasse of Chloe, who has been a petroleum engineering specialist with the Department of Mines.

Theodore M. Streit of Spencer will be the Deputy Director for Inspection and Enforcement. Street is a former administrator with the Oil and Gas Division of the Department of Mines.

The Governor also made the following appointments to energy related boards and commissions:

Board of Coal Mine Health and Safety — Charles A. Boggs III, Everett G. Acord, Joel R. Varian;

Reclamation Board of Review — John W. Straton;

Board of Miner Training, Education and Certification — James Justus, Porter J. Cotton;

Mine Inspectors Examining Board — David Shreve;

Oil and Gas Inspectors Examining Board — Thomas Dunn, Carl Morris;

Interstate Oil Compact Commission — Ron Potesta, Richard Muter.

Interview: WV Senate President Dan Tonkovich

GL — From your standpoint as president of the West Virginia Senate, what is the status of West Virginia coal?

Tonkovich — For one thing, it's suffering from severe competition, not just domestically, but internationally. You know, I've been chairing a U.S.-European coal dialogue for the last two or three years. That, more than anything, has helped me see the problems of the coal industry from two sides. One from the coal operators' side, and that is the type of environment in which they have to work domestically, and the environment in which they have to compete, internationally. And, it also helped me see the coal industry from the public official's standpoint. In working with the Europeans, I found that the American coal industry, the West Virginia coal industry in particular, have several obstacles to overcome in order to be able to compete effectively. Some are problems that government policy cannot overcome, and some others are problems that government has helped to create, and could help solve. What we have tried to do in this three year effort of marketing West Virginia coal is to try and overcome those barriers that we could do something about, such as the cost of transportation. Also, port development, recognizing that our ports are instruments of economic development.

GL — Does West Virginia coal have an image of its own internationally, as opposed to American coal?

Tonkovich — Again, from working with European coal buyers, I would say that they view American coal as West Virginia coal, since so much of what this country exports is West Virginia coal. I never heard in those three years, a European coal buyer talk about something unique in West Virginia, either negative or positive.

GL — Does that mean that West Virginia does not compete, with say western coal for the European market?

Tonkovich — No, it seems to me that the signing of the UMW/BCOA contract last year without a major strike had a significant impact on their perception of the reliability and stability of eastern U.S. coal. The Europeans look at American coal in certain positive ways. One is stability of supply, another is quality. But they always, when they talk about cost, they talk about competing with Poland, with South Africa, Australia, and now Colombia. And they recognize that they will pay a premium for American coal because of the positive features. But they won't pay an exorbitant rate which they feel is rooted in transportation rates. I talked to several buyers who were specific in saying that they didn't mind a slightly higher price for our coal, but they weren't about to pay higher rates simply to subsidize our railroads.

GL — As a legislative leader, can you identify major areas in which responsible government action can have a positive impact on the problems facing the coal industry?

Tonkovich — I think the past session illustrated a couple of areas. We started the process of building the relationship between government and industry by the attitude we took right here in the State Senate. For example, we welcomed the input of the coal industry in our effort to totally restructure the business taxes in this state. We recognize for the first time that we need a tax structure in West Virginia that stimulates the economy. In the past it seemed that we added or subtracted from our taxes in a hit-or-miss fashion. We had never before looked at our tax structure as an instrument of economic policy. I think we provided a forum that would help overcome the bigotries in biases of the past that if you were for something, then you had to be against something. If you were for business, then you had to be against labor. If you were a Democrat, you had to fight the Republicans. Our problems are so great, that we can no longer afford to let those biases rule. You can be for a working man or woman having a decent wage, a safe working environment and a secure retirement system, and at the same time you can be for a strong, healthy, competitive industry. We tried to utilize the talent in this state, whether it came from industry, labor, education or wherever. The Department of Energy bill is another example of this. We had input from all relevant sectors. We wanted to do what we could to develop and maintain a healthy industry, without sacrificing safety or environment. I think we in the Senate provided the leadership that said those goals are not mutually exclusive.

GL — Are there problem areas where the Legislature has no reasonable chance to have a positive influence?

Tonkovich — Well, you know there are certain things which the private sector does better. This is probably a bad time to talk about what the Legislature shouldn't do when there is so much that needs to be done. We hear talk on the national level about free trade, and we're probably the only country in the world that believes in free trade, and our businessses and industries are suffering because of that. I'm very excited to get started with the legislative session to build on what we accomplished last year.

GL — As we approach the 1986 session, do you believe there is enough common philosophical ground among the Senate, the House of Delegates, and the Governor's office to positively address coal issues?

Tonkovich — Well, let me tell you that from my perspective, I think there is. My commitment to the coal industry is strong and determined. I look forward to a continuing good relationship between the Democratic leadership in the Legislature and the Republican chief executive. You know that we didn't always agree. Last year the Governor vetoed some of our bills; we overrode a couple of his vetoes. But we moved on to the important things. We may have different ideas about how to achieve a goal, but our goals are basically the same. Our needs overshadow our differences. If the Governor meets us halfway, you're going to see another cooperative session between the legislative and executive branches.

GL — About the energy bill, where do we stand now? Are you satisfied with the form it took following enactment? And what role will the Legislature play this year in possible alterations?

Tonkovich — I reactivated the Select Committee on Economic Development. That has been the committee that has spearheaded Senate activity on economic development. The reason that I did this is because it will do things like review the legislation that we passed last year, to see where we may need to finetune or improve on it. It will also look at whole new areas that we didn't address last year that could be addressed this year. The Department of Energy bill was a very complicated piece of legislation and it's probably still unfolding as to how the executive will implement it. That's one area that the Select Committee will be looking at, and I'm sure that the whole Legislature will over the 60 day session, to see how we can improve upon what we did last year.

GL — So do you foresee some legislative action in regard to the energy bill?

Tonkovich — No action in the sense that we will have new legislation. That may or may not be the case. But you will see action in the form of our review of the legislation, to see how we can improve it, if that is necessary.

GL — Several members of the Legislature expressed regrets about the bill, following passage. Do you see an effort to backtrack on what was done last year?

Tonkovich — No, I don't think so. From what I've read in the media, there were some House members, and maybe a senator who said there were some provisions that they wish hadn't been included. I think that will be part of the legislative process, that each member will have the opportunity to look at that legislation, see what they like and what they don't like and introduce legislation that would be corrective. I see very little chance at all that we would undo what we did last year, concerning the creation of the Department of Energy.

GL — What about the "trackage" bill, which passed the Senate, but didn't get onto the House floor last year?

Tonkovich — That was a bill that I sponsored, and I did it partly out of frustration with our friends in the railroad industry. You know, historically the railroads and the coal industry have been partners. For some reason, that recognition of their dependence on one another has fallen apart over the last decade or so. When I see the needs that the coal industry faces, and when I hear both the domestic and foreign market buyers say that they would buy more American coal, more West Virginia coal if the rail rates were lower, and when I see the ICC not fully implementing the Staggers Rail Act the way I think it was intended where captive shippers and coal are concerned, I get very frustrated. It seems to me that there should have been better dialogue and more understanding between the railroads and the coal industry. The trackage rights bill was my way of saying to the rail industry, "If you can't recognize the social and civic responsibility that you have to the people of this State, if you can't recognize the very serious problems that our coal industry is experiencing, then government is going to find a way to do it for you." When it passed the Senate, it passed 34-0, and I think it sent a very clear message as to how this body feels about it. When it went to the House, I think it passed the House Finance Committee, and died on the last night of the session in the House Rules Committee. I think it was a bill that really would have gotten the job done in this state.

GL — Would that bill have passed had it reached the House floor?

Tonkovich — I'm very confident that it would have.

GL — Do you plan to reintroduce it this session?

Tonkovich — I intend to at this point. I also intend to do what I can working with the chief executive, and other leaders in this state to get the coal industry and the railroad industry together in a dialogue, a constructive dialogue to work out these problems, rather than having to do it in a confrontational manner, on the floor of the House or Senate. If the trackage rights bill helps to stimulate that dialogue, I'm going to continue to push it.


Tom's Mountain in McDowell County, the site of the consolidated Mt. View High School. Perry & Hylton did the work, under contract to Cannelton Industries.

From VA to PA with DoE

The new Department of Energy ran its first Interagency Evaluation Tour this fall, with no discernible difference from the operation of the old Department of Natural Resources.

But that was to be expected, as the old hands from DNR have stayed on under the DoE banner, and the tour was staged as smoothly as ever.

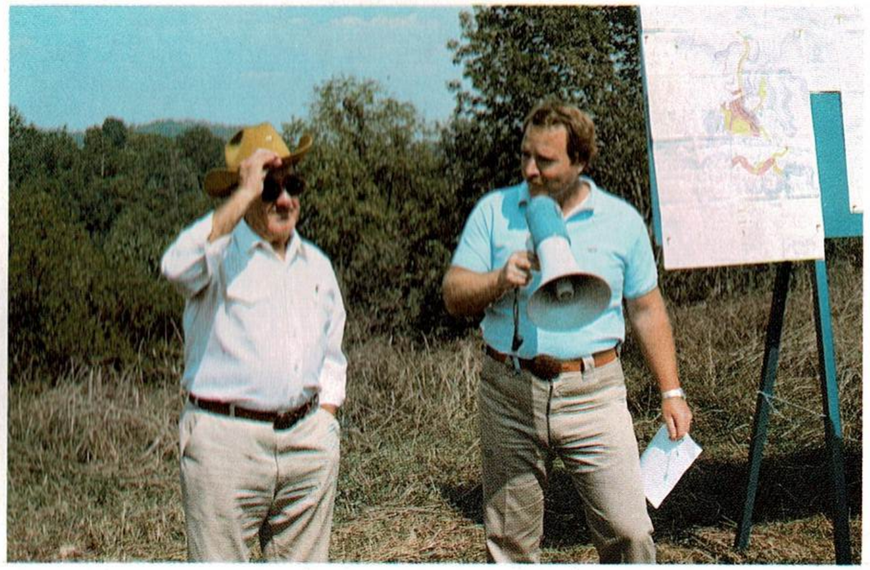
Some 100-150 individuals participated on some or all of the tour days. First timers, as always, were pleasantly surprised at the sophistication of traffic control and the convenience of catered lunches in the field.

Once again the move to a September schedule proved to be a good decision weather wise, as the "tourists" enjoyed a week of clear skies and mild temperatures.

Though the tour stops ranged from the Virginia border to the Pennsylvania line, the tour was actually quite compact. The southern stops were confined to McDowell County, and the northern to Monongalia, with the exception of a mid-week stop at Grafton Mining in Harrison County.

Reclamation work under the industry financed Abandoned Mind Lands program is assuming a larger role in the tour schedule, as the first large batch of contracted work matures, only eight years after the program was created under the Surface Mining Control and Reclamation Act.

West Virginia was the first state to host such an event, and 17 years later, the tour stands as another area of leadership for the state in the field of mining and reclamation.

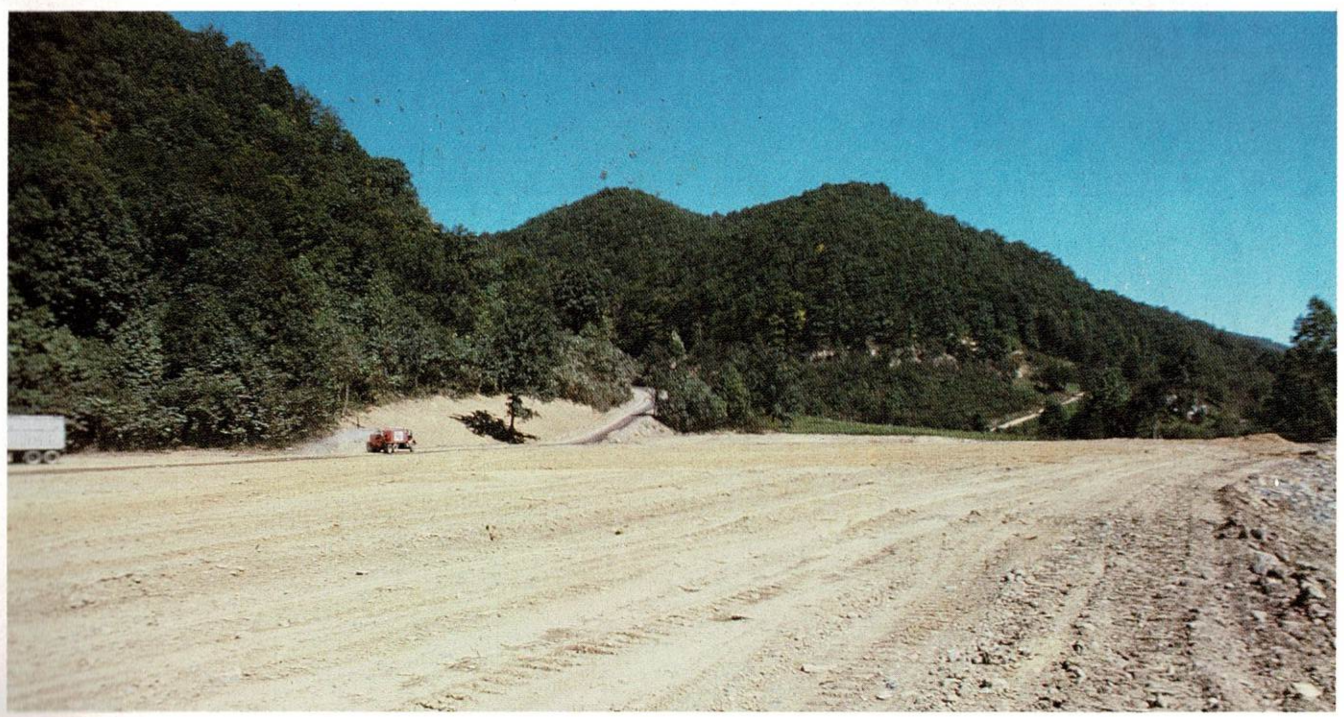


Charlie Miller of Grafton Mining introduces company President C.E. "Jim" Compton.

Grafton's scenic entrance to its contour operation near West Milford, in Harrison County.

Grafton's excellent program of concurrent reclamation provides new mown hay within sight of the active mining operation.

Abandoned Mine Lands projects were a large part of this year's tour. Shown above is the Little Fork Refuse project, McDowell Co., contracted by Black Gold Coal Co.



The Bradshaw Refuse Project, also in McDowell County, involved moving unstable refuse material in the town of Bradshaw to an unused hollow to create valuable flat land. The contractor was G.E. Ray.

With the Goshen Road Project, in Monongalia County, contractor General Paving Co. is reclaiming 40 acres of coal refuse and correcting problems with deep mine drainage.

The art of modern reclamation often goes beyond legal requirements to provide scenery that is picturesque in any context. Such is the case with this sediment pond on Dipple and Dipple Coal Co.'s mine in Monongalia County.

The tour visited three Consolidation Coal operations in various stages of development. Shown here is the company's active contour operation on Shawnee Mountain in McDowell County.

Consol's Horsepen operation, McDowell County.

Having begun on the border of Virginia, the tour winds up on the Pennsylvania line, at this operation of Concorde Corp.

Michigan 475CT/Euclid R-50 Matched team cuts load/haul cycle time.

Pass for pass, cycle for cycle, high production pair.
This tightly matched cost efficient, load/haul team trims time from the work cycle, increases productive machine time, builds a smooth production flow. Cost per ton drops, production rises, profitably.

Shorter, faster, loader moves. Quicker loader response.
Except for forward and reverse, the Turbo-Transmission equipped Michigan 475C requires no shifting during the work cycle. There are no clutches. The limited slip differentials (standard on the 475C) are self-sensing, minimize wheel slipping, reduce tire chunking, boost tire life.

Loader power is always there.
The engine runs at constant speed in the work range. The operator gets what he needs when he needs it: rimpull, bucket breakout, responsive hydraulics . . . even uphill under load. And there's a 10,000 hr. or 30 month warranty on the Turbo Transmission.

The R-50, Easy spot. Big target. Big power.
The Euclid R-50 turns tight, spots easily. Wide, low body provides excellent loading target. New, fuel efficient engines cut fuel consumption and team with other power train components to handle steep ramps, attain safe, top speeds on flat runs.

Truck design boosts job time. Cuts shop time.
Brakes exceed industry performance standards, have fewer parts, are easier to service. Major components: engine, transmission, suspension are fully accessible. There's no horsecollar. Transmission is remote mounted.

475C/R-50 Two of many Clark Michigan products.
The 475C is one of 10 Michigan loaders, the R-50 is one of 14 Euclid haul trucks available from your Clark Michigan Company Distributor. No one can match your load/haul needs better. Talk to him or us.

Fanco's dedication was a first class affair, complete with West Virginia Governor Arch Moore, and a literal trainload of dignitaries.

State of the Art in Fanco

Diamond Shamrock Coal Co. and Chessie System Railroads celebrated the unveiling of a state-of-the-art unit train coal loading facility by importing a trainload of dignitaries for the ceremony at Fanco in Logan County.

West Virginia Governor Arch Moore highlighted a parade as a landmark in the modernization and forward progress of the state's coal industry. Joining the Governor were Diamond Shamrock Coal President Robert Garbesi, Chessie Chairman John Snow, National Coal Association President Carl Bagge, Acting WV Energy Commissioner Ken Faerber, and Herbert Jones, representing the Amherst Division of Diamond Shamrock.

The Fanco facility is completely computerized and is designed to process 600 tons of raw coal per hour. A covered conveyor delivers 3500 tons per hour from the 100,000 ton stockpile area into the loadout building where it is weighed by a computer-controlled automatic loading system. The weighed coal can be loaded into a 100 car unit train in less than four hours as the train moves under the loadout facility.

The new facility is the latest example of the recent move toward unit train shipping in the coal industry. Chessie reports that of the 98.8 million tons on which it originated shipment in 1984. 28% was loaded by unit trains. This figure is expected to reach 50% by 1988. Chessie has encouraged the expansion and construction of unit train loadout facilities by subsidizing the cost of needed coal sidings.

Fanco becomes the 70th unit train loadout facility in West Virgina. An Additional 33 facilities are in the planning and construction stages.

Black Locust in the Reclamation Equation

By W. Clark Ashby, Willis G. Vogel and Nelson F. Rogers
Forest Service, Northeastern Forest Experimental Station.

Abstract

Black locust (Robinia pseudoacacia) has been planted and seeded more than any other tree species on lands surface-mined for coal in the Eastern United States. Benefits from planting black locust are: it provides quick cover for stabilization and esthetics; it supplies nitrogen and nutrient-rich litter to soil; it improves the site for establishment of other higher quality trees; it grows in a wide range of minesoil conditions, including extremely acid soils; it grows better than most trees in soils compacted by grading and topsoil practices; it can be established by seeding and it is useful for posts, fuel, and biomass production. Problems associated with planting black locust are: it may overtop and damage companion trees; it may be susceptible to locust borer damage; it spreads to adjacent open areas by root suckers and seed; its thorns are hazardous to people and equipment; and seeded stands may be nearly impenetrable to about 6 to 8 years of age. Black locus continues to have an important place in mined-land reclamation; planning for best use is warranted.

Introduction

A major goal in reclaiming disturbed lands is to develop a vigorous plant cover. Trees have been used widely and successfully for this purpose. Black locust (*Robinia pseudoacacia*) has been one of the best species, though it has limitations for some uses.

Early uses of black locust were along roadsides and in gullied fields to stop erosion and enrich soil nitrogen. As surface mining for coal evolved, this native legume was used in reclaiming mined lands, where often it grew faster than on unmined lands (Limstrom 1960). It is one of the most adaptable trees used in reclamation and has been planted more than any other tree species on mine-land spoils in the East. Black locust has been planted in pure stands and in mixture with other trees on many types of minesoils throughout the Appalachian and Interior (Midwest) Coal Provinces.

A key feature of black locust is that it is a pioneer species, and surface mines are pioneer sites. Important contributions of this species in reclaiming surface mines are that it: enhances soil development by supplying nitrogen and nutrient-rich litter and improving infiltration; provides quick cover for erosion control and improved water quality; fosters successional development of high-quality forest stands; furnishes food and cover for wildlife; contributes to landscape design and esthetics; screens unsightly views; and limits access, at least temporarily, to hazardous and environmentally sensitive sites.

When black locust was first used on surface mines, methods of mining and reclamation were much different from today's regulated practices. Little or no attempt was made to segregate different geological materials lying above the coal. The resulting mixture that was piled in ridges and hills became the rooting medium. Often, this medium was not good for plant growth; however, black locust was able to survive and grow on many of these sites where most other tree species failed.

Public concerns about mined areas that were not being suitably reclaimed led first to passage of state laws, and later to the Federal Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87). Numerous regulations aimed at achieving certain land uses resulted from this law and brought about changes in handling of soil and plant materials during reclamation. Planting of black locust has continued, but these regulations have introduced new obstacles to successful establishment of woody species. The record of tree growth under these new conditions is necessarily short, but locust promises to be especially useful in adapting to postmining conditions.

Ways to Plant Black Locust

The versatility of black locust is seen in the ways it can be planted and used. Some plantings are for direct use as fenceposts, biomass, and barriers, and for erosion control, landscaping, and environmental quality. Black locust also enhances soil building and site quality. It can serve as a nurse crop for more valuable hardwoods planted either with the locust or after the locust stands have improved the site and begun dying off, or which volunteer during natural ecological succession. Many of the locust stands planted on mined lands have deteriorated at age 15 to 30. Black locust is intolerent of shade and does not regenerate well under its own or other tree canopies. Stands can be managed, usually by cutting that results in regeneration from sprouts. Individual trees have persisted without management in some stands.

Locust commonly spreads by root suckers into adjacent open areas. Spreading can be advantageous in revegetating refuse sites, controlling erosion, and covering bare areas. Where not desired, chemical or mechanical control can be used.

Planting Seedlings

The spacing and number of black locust seedlings planted per unit area may vary depending on the intended use. Where planted alone, spacings have ranged from 7 by 7 feet or about 890 stems per acre, to 4 by 4 feet or about 2,725 stems per acre. Closer spacings are used mostly on steep slopes and potentially unstable sites and for barriers or screens. Densities of older stands may be greater than desirable even with the 7-by-7 foot spacing. Where used as a nurse or companion crop for other hard-woods, black locust may account for 25 to 50 percent of the total trees planted. Planting a locust in every other planting space in every other row provides a 25-percent composition. A simpler approach is to plant every third row to locust.

State-operated forest nurseries are the chief source of black locust seedlings for large-scale plantings. Lesser numbers are available from some commercial nurseries. One-year-old (1-0) seedlings are planted almost exclusively in the Interior Coal Province (Indiana to Kansas) as an alternative to direct seeding in the Appalachian Coal Province (Pennsylvania to Alabama).

Five hundred or more seedlings can be hand planted per day by one person, and several times that many with a tree-planting machine. Planting bars or mattocks are used for hand planting. An added advantage with machines is that they can be equipped with a spray apparatus for simultaneous herbicide application to control herbaceous competition and for fertilizer applications to correct soil nutrient deficiencies.

Direct Seeding

Black locust is one of the earliest tree species to establish by direct seeding; seed are commercially available at moderate prices. The small, hard seeds are prevented naturally from premature germination on harsh sites. Seed can be scarified with sulfuric acid before planting to increase the percentage of early germination. This increases the need to protect seed and newly emerged seedlings from climatic stress. Use of moderate amounts of bark or other mulch with treated seed has provided conditions for increased survival of seedlings on field plots (Roberts and Carpenter 1983). Other causes of seed or seeding loss are erosion and animal use.

Black locust seed can be broadcast by hand or mechanical seeders or drilled. Most seeding, especially in the Appalachian Coal Province, is done with hydraulic seeders that spread mixtures of grass, herbaceous legume, and locust seed as well as mulch and fertilizers in one application. Locust usually is seeded at rates of 1 to 3 pounds of pure live seed per acre (Vogel 1981). Newly germinated locust seedlings may be difficult to find in dense covers such as those of sericea lespedeza (*Lespedeza cuneata*) or Kentucky-31 tall fescue (*Festuca arundinacea*), but after 2 to 3 years, a dense stand of black locust sapplings is visible. Usually, canopy closure and a decrease in stand density soon follow.

Use of Amendments and Herbicides

Both planted and seeded black locust, unlike many tree species, repond positively to fertilizers applied at planting. Growth of locust is increased on most minesoils by phoophorus fertilizer; nitrogen applied with phosphorus usually results in additional early-growth response. In an experiment on extremely acid spoil in eastern Kentucky, dicalcium phosphate, rock phosphate, or treble super-phosphate similarly increased growth response by planted locust seedlings. The phosphate fertilizer was mixed with soil in the planting holes and nitrogen fertilizer was applied in slits about 8 inches from the seedlings This was done to prevent direct contact of the nitrogen fertilizer with seedling roots. Survival after 3 years was not affected by any of the fertilizer treatments (Plass 1972).

In a similar experiment application of (1) lime alone, (2) lime and fertilizer, and (3) lime, fertilizer, and straw mulch increased the survival and growth of black locust seedlings planted on extremely acid spoil in eastern Kentucky and Ohio. A significant growth response resulted from each additional amendment (Table 1). The Fertilizers, dicalcium phosphate and ammonium nitrate, were applied in and adjacent to the planting holes as in the experiment cited previously. Ground limestone was mixed into the upper 4 inches of spoil. These treatments would be too costly and unnecessary in reclamation prescribed by present regulations. However, they may be useful in revegetating acid-toxic spoils such as those found on some abandoned mined areas.

Establishment and growth of seeded black locust can be enhanced with amendments. The broadcast application of treble superphosphate on eastern Kentucky spoils seeded to black locust produced seedlings the first year that were 3 to 5 times taller than seedlings on unfertilized spoils. Nitrogen fertilizer applied with phosphorus resulted in additional growth, but the nitrogen was not necessary for success of the locust (Vogel and Berg) 1973. Locus roots have nodules in which *Rhizobium* bacteria fix appreciable amounts of nitrogen.

Under current regulations, trees are planted in or with a grass and legume ground cover that is established for erosion control. The application of fertilizer increases growth of the ground cover which, in turn, increased competition with the trees. Black locust usually is more successful than other trees in becoming established in such ground cover (Vogel 1977).

Use of herbicides to control herbaceous competition has improved tree survival and growth. Herbicides must be used as specified, and their effectiveness varies depending on soil leachability, seasonal weather conditions, and types of plants to be controlled. Damage to black locust trees from proper use of a wide spectrum of herbicides has ranged from none to significant depending on the chemical and dosage (Whte and Rolfe 1983). Bentazon and 2,4-DB reduced the growth of locust seedlings.

Survival and Early Growth

Black locust seedlings ranked well compared to other kinds of trees in USDA Forest Service studies fo survival and early growth on prelaw ungraded spoils. The number of surviving black locust trees in Illinois after 10 years exceeded 70 percent on those planted except on densely vegetated areas or very acid spots, where survival was less than 20 percent for any tree species tested (Boyce and Neebe 1959). After 10 years, black locst survived and grew better than other trees tested in Ohio (Finn 1958) and western Kentucky (Boyce and Merz 1959), and was rated good in independent studies in Pennsylvania (Hart and Byrnes 1960).

Spoils at most of the planting sites in Illinois and Indiana were neutral to moderately alkaline. Survival of black locust on these spoils tended to increase with an increase in pH, a relationship not found for the more acidic minespoils of the Missouri, Kansas, and Oklahoma plantings (Table 2). Survival of black locust after 11 years on acid bituminous spoil in Pennsylvania was 50 percent or better only on spoil with pH levels above 3.6; tree height on the three best sites averaged only 10.1 feet (Davidson 1979). In general, growth in Illinois, Indiana, Missouri, Kansas and Oklahoma was relatively independent of pH (Table 2). Adherence to current reclamation requirements should result in a minesoil pH range suitable for good survival and growth of black locust.

Locust Mortality and Tree Invasion

The canopy formed by rapid early growth of black locust often does not persist. There may be a large loss of trees and breakup of the stand. Mortality, breakage, and growth loss in black locust stands often occur by age 15. These symptoms of decline are caused primarily by the locust borer *(Megacyllene robiniae)* and to a lesser degree by the twig borer *(Ecdytolopha insiticiana)*, the leaf miner *(Adontota dorsalis)*, and rimosus heart rot *(Fomes rimosus)* (Hoffard an Anderson 1982). Large monoculture stands are more susceptible than dispersed individual trees to attack from exploding populations of insects.

Borer attacks are least severe, or absent, on vigorously growing trees (Hall 1933). Shade, highly correlated with lessened attacks, may be an effect of unbroken crown canopy which develops quickly from vigorous trees. Drought, acidic spoil, fire, or other damage that weakens trees and retards canopy closure may lead to increased borer damage. In southeastern Kentucky, borer damage may be found on black locust growing on sites disturbed by surface mining and road building,

Table 1.—Survival and growth response of planted black locust to lime, fertilizer, and mulch on acid surface-mine spoils in eastern Kentucky and Ohio after 3 years

Treatment	Survival		Height	
	Kentucky	Ohio	Kentucky	Ohio
	- - Percent - -		- - Feet - -	
Control[a]	60	60	2.4	3.6
Lime[b]	100	75	5.3	5.2
Lime and fertilizer[c]	100	90	11.3	6.9
Lime + fertilizer + mulch[d]	95	95	13.6	8.7

[a] Average pH of unlimed spoil: Kentucky 3.8; Ohio 3.3.
[b] Finely ground agricultural lime applied at rate of 15 tons/acre and worked 4 inches deep into spoil.
[c] Ammonium nitrate and dicalcium phosphate fertilizers applied at rates equivalent to 50 lb of nitrogen and 100 lb of P_2O_5 per acre.
[d] Straw mulch 2 to 3 inches deep held in place with poultry wire.

though such damage usually is not found on locust that regenerated naturally after logging of forest sites.

It may be that susceptibility to borer damage is greater for black locust outside the original range for this species. A more favorable forest environment and the presence of better adapted genetic strains in the natural range may lessen the prevalance of borer attack. Much of the commercially available black locust seed used for nursery plantings and in direct seeding originates in Europe from genotypes of unknown origin taken there many years ago.

Several studies have documented the general opinion and numerous observations that mortality is widespread in locust stands on disturbed lands. For example, a locust stand in southern Illinois planted in 1938, 3 years after mining, had 2,700 trees per acre after 1 year, 1,170 per acre after 10 years, and 400 per acre after 15 years (Ashby et al. 1966). As locust trees died they were replaced by boxelder *(Acer negundo)*, elm *(Ulmus spp.)*, and other mesic hardwoods. Woodland herbs, predominantly white snakeroot *(Eupatorium rugosum)*, has formed a continuous ground layer. Natural mortality in black locust stands in eastern Kentucky was similar at 10 years to that in the stand in southern Illinois (Eigel et al. 1980).

Detailed studies of a hydroseeded stand in Bell County, southeastern Kentucky, showed 290 black locust trees per acre 12 years after seeding, with a third of the trees dead. Most of the 195 live trees per acre were less than 4 inches in diameter and would not have been commercially valuable for posts. The locust had grown through an initially thick stand of sericea lespedeza and Kentucky-31 tall fescue to form a dense thicket of seedlings at about age 6. At age 12, about one-third of the area had a ground layer predominantly of Ky-31 fescue, while the majority of the area had a dense, waist-high cover of white snakeroot, touch-me-not *(Impatiens capensis)*, pokeberry *(Phytolacca americana)*, and other woodland herbs. Borer damage was nil and little locust regeneration was observed. Only 32 stems of woody invaders per acre were counted, about half of them shrubs. Sugar maple *(Acer saccharum)*, red maple *(A. rubrum)*, and ash *(Fraxinus spp.)* accounted for most of the tree invasion. Lack of seed sources, or the vigor of the herbaceous layer, may have been the reason for the meager tree invasion. Some older stands in southeastern Kentucky have shown continued locust mortality with numerous invading trees of other species that later formed a continuous canopy. Locust is shaded out as the new trees grow taller.

The kind and number of trees that invade or volunteer in black locust stand differ from those invading in planted stands of other tree species. They also differ from one minesoil type to another. In Ohio, for example, black cherry *(Prunus serotina)* volunteers were more abundant in plantations of black locust than in plantations of other species, and were more abundant on acidic and neutral spoils than on calcareous spoils (Larceon 1984).

Regional differences have also been noted. In illinois, 30-year-old locust stands were invaded preferentially by boxelder and elm, in Illinois and Indiana by sugarberry *(Celtis laevigata)* and hackberry *(Celtis occidentalis)*, and in Missouri and Kansas by red mulberry *(Morus rubra)* (Ashby et al. 1980). In Indiana, Japanese honeysuckle *(Lonicera japonica)* has formed deep

Table 2.—Spoil pH and black locust survival and growth on plots in Illinois and Indiana, and in Missouri, Kansas, and Oklahoma[a]

Illinois/Indiana				Missouri/Kansas/Oklahoma				
pH				pH				
1947	1976	Survival	D.b.h.	1948	1976	Survival	D.b.h.	Height
		Percent	*Inches*			*Percent*	*Inches*	*Feet*
3.4	4.7	16	7.7	3.7	5.7	50	5.3	44
4.3	4.8	21	4.5	4.5	6.5	34	5.6	40
6.1	6.1	16	6.5	5.1	5.5	42	5.8	39
6.9	7.0	38	5.0	5.2	5.9	19	5.1	39
7.2	7.7	38	7.5	5.9	7.5	34	5.1	37
7.5	8.2	35	7.2	6.0	5.8	40	6.9	42
7.6	7.2	30	8.2	6.3	7.3	11	7.3	48
7.6	7.7	34	6.5	6.5	6.3	54	6.7	41
8.0	7.8	30	6.1	6.8	6.7	41	7.1	46
8.1	8.1	64	6.8	6.8	6.5	22	6.6	34
8.2	6.0	42	4.1	7.5	7.4	43	6.3	46
8.3	7.6	66	7.0					

[a] Survival and growth measured in 1976; trees planted in 1947.

mats of vines between and on the remants of pure locust plantings.

To summarize, as black locust die from whatever cause and stand densities decrease and give way to a more open overstory, the existing herbaceous ground layer is maintained, or one develops. Shade-tolerant, cool-season grasses, especially Ky-31 fescue, that often are seeded with the locust commonly form a dense ground cover that persists and even thrives with the locust This fescue-locust community frequently found on reclaimed surface mines in the Appalachian and Interior Coal Provinces appears to be unusually stable. Where not dominated by Ky-31 fescue, crown vetch *(Coronilla varie)*, or other shade-tolerant species, the main groundcover component under open locust stands typically is the woodland herb flora described earlier. Sericea lespedeza where sown with grass and black locust typically dominates the ground cover for several years, but seemingly is reduced in density or shaded out when the locust canopy closes. Tree invasion that eventually replaces the locust takes place a varying rates depending on type of herbaceous understory and the proximity and kind of forest-seed source.

Interplanting and Underplanting with Other Trees

Three methods of improving or creating hardwood stands in black locust plantings are (1) interplant desirable trees with locust, (2) underplant deteriorated locust stands, and (3) cut out or chemically kill the locust and replant with desired species. The first two have been of greatest importance on surface mines. Selection of shade tolerant companion trees can enhance the probability of success.

A major reason for planting black locust with other more desireable or commercially important trees is the role of locust in improving soil and supplying fixed nitrogen to companion trees. Also, planting grees is a way to control stand composition of desirable species. Natural plant succession, too, brings new kinds and numbers of trees, but these often are of less value for forest products, for example the elm or mulberry listed previously.

Hardwood-black locust mixtures have been evaluated for survival and growth both of the locust and of the associated species. Sometimes direct comparisons of each species planted alone, and mixed, were possible. In other cases, the experimental design of 30 years ago only allows inferences from reasonably comparable plantings.

Black locust in mixed plantings generally had similar or better survival than in pure plantings (Table 3). Growth after 30 years was variable. Locust trees tended to be larger in plantings with the higher percentages of black locust in the mixture. The values were affected by different companion trees planted with locust in the several areas, by amount of locust borer damage, and by climatic stress and other environmental factors.

The primary interest and concern in interplanting is the influence of black locust on the growth of companion trees. Interplanting with black locust has in some cases enhanced and in others limited the growth of companion trees. Several early reports on mixed plantings indicated overtopping and crowding of companion trees by locust and damage from wind whipping of tender shoots by thorny locust branches. Despite these early adverse effects, several companion species have grown well (Ashby and Kolar 1977).

Table 3.—Thirty-year survival and growth of black locust in pure stands and mixed with other trees. Ohio data from Larson and Vimmerstedt (1983).

Area	Survival	D.b.h.	Height
	Percent	*Inches*	*Feet*
		PURE LOCUST	
Ohio	18	5.3	28
Indiana	68	5.5	41
Missouri	39	6.5	42
Kansas	33	5.4	40
Oklahoma	11	7.2	48
		MIXED	
Ohio	34	5.0	28
Indiana	64	6.9	55
Northern Illinois	34	5.7	—
Southern Illinois	22	7.2	—
Kansas	25	6.7	49

Interplating pines *(Pinus spp.)* with locust has not been very successful. Kellogg (1936) reported failure for numerous pine species interplanted with locust. Larson and Vimmerstedt (1983) found that only 13 percent of the white pine *(pinus strobus)* that had been interplanted with black locust survived after 30 years. This compares with 21 percent survival where pine was not interplanted. Tree diameter also was greater for pine not interplanted. One study in southeastern Ohio showed enhanced growth of trees planted in mixture with black locust on acid spoils. At age 10, tulip poplar *(Liriodendron tulipfera)*, green ash *(Fraxinus pennsylvanica)*, and redcedar *(Juniperus virginiana)* were 228, 268, and 194 percent taller, respectively, where interplanted with locust than where planted in pure stands. Total nitrogen content in leaves was 166 percent greater on trees planted with locust (R.F. Finn and R.W. Merz, unpublished report, Central States Forest Experimental Station). Though associated with better tree growth, higher nutrient content in plant tissue may produce undesirable side effects. For example, deer browsing was greater on pines growing near black locust than on those not near locust in Pennsylvania (Davidson 1970).

Growth differences at age 30 were not great between trees planted alone and trees mixed with locust in several states (Table 4). Two of seven comparisons showed greater diameter with locust, while the other five showed better growth where planted alone. Older comparisons are not available to predict the future growth of these stands.

If suppression by black locust limits early growth of interplanted companion trees, underplanting deteriorated locust stands may avoid this problem and take advantage of improved soil conditions. Results of underplanting have ranged from failure to highly successful, with little explanation for the differences. Data on tree performance in underplanted black locust stands compared with plantings in the open are not available. A comparison of underplanted locust versus underplanted shortleaf pine *(Pinus echinata)* of the same age generally showed better survival of trees planted under the pine but better growth under the black locust (Ashby and Kolar 1977). By age 37, 30 years after the underplanting, survival of both locust and pine was 6 percent.

We do not know of surface-mined areas planted after the complete removal or deadening of black locust. The residual effects of harvested locust have supported superior growth of hardwoods on poor, old-field soils (Carmean et al. 1976).

Table 4.—Thirty-year growth of hardwoods and white pine planted alone or mixed with black locust on Indiana, Kansas, and Ohio strip mines. Ohio data from Larson and Vimmerstedt (1983).

Species	D.b.h.		Height	
	Alone	Mixed	Alone	Mixed
	- - *Inches* - -		- - *Feet* - -	
Sweet gum (*Liquidambar styraciflua*) (IN)	8.8	7.2	62	57
Red oak (*Quercus rubra*) (IN)	8.1	6.9	62	53
Silver maple (*Acer saccharinum*) (IN)	6.0	7.3	58	56
Black walnut (*Juglans nigra*) (IN)	5.0	4.1	47	36
Black walnut (KS)	3.0	3.6	23	31
Tulip tree (*Liriodendron tulipifera*) (OH)	6.2	6.0	38	35
White pine (*Pinus strobus*) (OH)	7.3	6.0	34	33

Grading Effects on Trees in Reclamation

Significant changes in post mining soil conditions have been noted following enactment of state and Federal reclamation laws. Where chemical factors once were perceived as the major limitations to plant growth, today, much concern and research is directed toward physical limitations, chiefly those associated with grading.

Grading landscapes are much more complex than often realized. The smooth surfaces may hide differences that became evident only after trees are planted. Studies on graded versus undergrated pre-law minesoils showed that grading interacted with site and spoil conditions to produce several types of tree-growth response. In an Ohio study, black locust grew better on the fill material on graded spoil bank that on the cut area from which the fill material was removed. Average tree height on partially graded banks was greater than on leveled banks and about the same as on ungraded banks. Tree growth was best on side slopes of the partially graded and ungraded banks.

Locust on plots partially leveled by dragline pullback in southern Illinois had a diameter at breast height (d.b.h.) of 6.5 inches after 30 years compared to 7.7 inches on undergraded plots. Survival percentages were equal even though spoil pH was 6.1 and 3.4 for the graded and ungraded plots, respectively. The grading limited tree growth more than the extreme acidity.

There was little difference in locust survival, d.b.h., and height on unleveled, partially leveled, and completely leveled plots in Ohio though trees on the partially leveled area had a significantly smaller average d.b.h. than on the other two areas (Larson and Vimmerstedt 1983).Detrimental effects of grading on height growth of locust were found in West Virginia by Brown (1973). We found 2 to 11 percent greater diameter and height growth of locust after 30 years on ungraded areas than in similar plantings on graded minesoils in Missouri and Kansas. The effect of possible interactions of soil compaction with borer damage or other factors on locust were not identified in these studies.

Grading was beneficial to survival and growth of black locust on coarse-textured anthracite minesoils in Pennsylvania (Czapowskij 1970). Locust survival after 5 years averaged 64 percent on graded and 22 percent on ungraded coarse spoil materials. Rolling and sliding rocks and erosion caused considerable mortality on ungraded banks. Trees were 9.8 feet tall on the graded sites and only 4.6 feet on the ungraded. On an area with finer textured soils (sandy clay loam), the average height of trees on the graded site was 6.2 feet compared to 5.2 feet on the ungraded. Thus, grading appears to benefit growth of black locust on coarse-textured materials, but is detrimental to growth on finer textured minesoil materials such as are commonly found in the Midwest.

Growth of black locust at age 10 was less affected by grading than three other tree species in Ohio (Finn 1958). At age 30, locust had the highest survival but not the best growth of 13 species planted on graded sites in Missouri, and the second best survival in Kansas. Our recent studies in Illinois showed that survival of black locust after 2 years was only 40 percent on graded sites compared to 100 percent on ungraded sites. Tree height averaged 4.9 feet on graded and 11.5 feet on ungraded sites. Development of root systems also was markedly reduced on the graded spoils. Even so, the locust had deeper roots and grew more vigorously than the other 12 kinds of trees planted on the graded sites.

Black locust recently has been planted on graded agricultural minesoils to test the hypothesis that locust root systems are more effective than alfalfa *(Medicago sativa)* or sweet clover *(Melilotus spp.)* in penetrating compacted soil layers. Locust may well be a good choice for improvement of minesoils in the early years after mining and before planting corn and other row crops. This would be a means to offset adverse effects caused by grading the replaced fine-textured surface-soil materials.

Consumptive and Other Uses

Black locust is a relatively dense wood with high value for firewood. It ranked 6th (behind oak) in density and heat value out of 33 woods reported by the USDA Forest Service (n.d.). The cutting and removal of firewood should limit the buildup of borer populations and encourage sprouting to renew the stand.

Black locust is one of the most promising species to plant on surface mines for production of wood for industrial heating and generation of electric power, and as a chemical feedstock. Young stands typically are harvested for such biomass production. The wide adaptability of locust to a diversity of sites, its nitrogen-fixing capacity, and quick growth provide an early harvestable crop (Eigel et al. 1980). Locust sprouts are more vigorous than the original planting and have produced more than 2.25 tons per acres of biomass per year in western Kentucky (Carpenter and Eigel 1979). Locust had superior performance in a Kansas energy forest (Naughton 1980).

Letting the stand grow to a size for fenceposts or mine props is a traditional use of black locust (Rogers 1951). Fencepost production may well be deferred to a sprout generation to gain vigor, a denser canopy, and stands less subject to borer attacks (Finn and Limstrom 1957). Where not exposed to borer attack before a sprout canopy is renewed, better trees could be left for posts during short-rotation harvesting for biomass or firewood.

Living fenses or barriers of black locust can be useful for public safety, for example, next to ramps, steeper shores of strip-mine lakes, roadways, and industrial sites. They help prevent acess by off-road vehicles or other trespass into reclaimed fields or forest plantings. The barrier can be renewed and maintained parallel to the areas of interest by harvesting alternate strips for biomass and to bring about sprout production.

Profuse flowering by black locust provides springtime color. The flowers are eagerly sought by bees and furnish pollen and nectar that contribute to the buildup of bee populations and honey production later in the season. Locust trees planted along the edge of an alfalfa or clover pasture provide early-season support for bee populations.

Wildlife values of black locust are variable. It's rapidly developing cover contributes to habitat for numerous birds and mammals. Locust is a good producer of seed that is a major food resource for quail in winter.

Benefits and Problems Using Black Locust

Mining permits or reclamation plans are prepared to fit site and land-use requirements for each mine. The overall desirability of using black locust will depend both on site conditions and on the projected postmining land use. The following is a summary of many of the potential benefits and problems from including black locust in reclamation planning and plantings.

Potential Benefits

1. Can be planted as seed or seedling; both care readily available and relatively inexpensive.
2. Is adapted to a wide range of climatic and soil (spoil) conditions.
3. Usually grows faster than other kinds of trees the first several years after planting.
4. Survives well in competition with with grasses and other herbaceous cover.
5. Promotes soil permeability and water entry which in turn decreases surface runoff and erosion.
6. Has root nodules with bacteria that fix nitrogen symbiotically.
7. Produces leaf and woody liter that contributes to rapid building of soil organic matter and cycling and availability of nutrients.
8. Will spread by root suckers in coal slurry and other unstable rooting media, resulting in dust and erosion control.
9. Produces quick cover and screening for erosion control and landscape and esthetic enhancement.
10. Young dense stands can furnish an effective barrier against trespass or entry to other plantings and hazardous areas.
11. Produces large quantities of cordwood for fuel or charcoal.
12. Produces substantial biomass with early regrowth from root suckers and stump sprouts after cutting.
13. Under favorable growth conditions, provides short-term production of cordwood or durable fenceposts.
14. Afford habitat for several kinds of wildlife. Seed is prime food for quail in some regions.
15. Supports bee colonies and honey production by early spring flowering.
16. Natural release of interplanted or underplanted timber trees can result from borer attack or other causes of locust mortality.

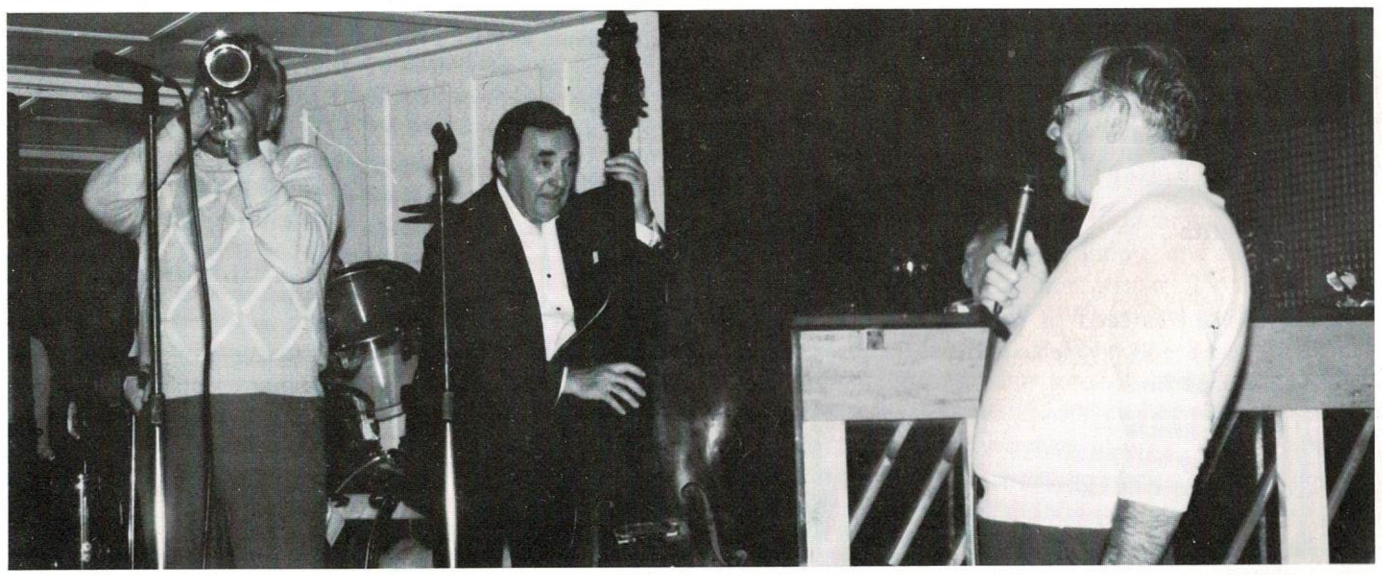
Potential Problems

1. Pure stands, particularly direct-seeded one, are nearly impenetrable during the thicket state from about age 2 to 8.
2. Thorns can be a hazard to people and equipment when underplanting or harvesting.
3. May be too competitive where planted with other trees in mixed stands. This problem can be alleviated by choosing suitable percentages of locust in the mix, suitable spacings between trees, suitable timing of plantings.
4. Cannot grow under shade.
5. In some plantings, especially on poorer sites, locust borer often destroys the commercial potential for fenceposts and firewood.
6. Unless controlled by management, vigorous sprouting after intensive cutting reduces the chance to introduce more valuable trees.
7. Spreads into adjacent unmanaged open areas.

These benefits and problems encompass a range of potential uses both on lands newly mined and on older mining operations still needing revegetation. A new era for use of black locust has opened with the need to overcome limitations of compaction on graded minesoils. Its vigorous root-system is useful for improving soil physical and chemical conditions prior to development of agriculture row-crop production. Black locust has the potential to contribute significantly to accelerated forest development within the framework of current regulatory requirements. This species remains a valuable biological resource for meeting diverse needs in reclamation. If full advantage is taken of this potential resource, the reclamation equation will include the planting of millions more black locust seedlings and seed in the years to come.

Friday night...

Saturday...



and Saturday night.

Rootin', Tootin', and Hootin'

Lawson Hamilton and Benny Benack, two old musical friends, made a weekend of it in Morgantown last month as the Association Board of Directors gathered for their fall meeting and a Mountaineer football game.

Benny Benack is a professional musician, one who obviously enjoys his work. Lawson Hamilton is a coal operator, but as his friends and family will tell you, he's a musician at heart.

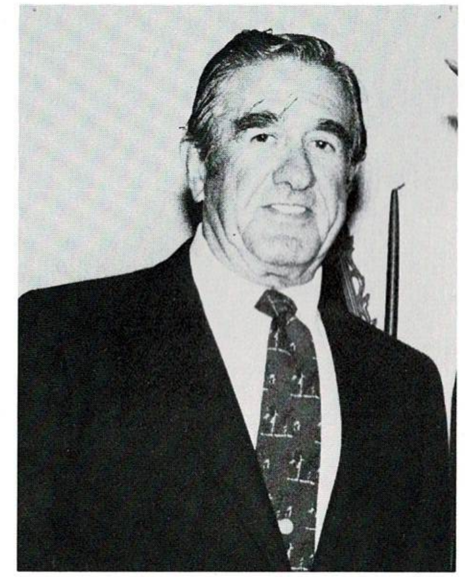
Benny struck up his band toward the end of dinner on Firday night, and Lawson became the lead singer shortly after dessert. Presumably the two got a good night's rest, but you couldn't prove it by the folks who returned for Saturday brunch and found them still on stage, tootin' and rootin' for the Mountaineers. At least they changed clothes.

The fall meeting traditionally ends with the football game. But Benny and Lawson hadn't yet played out their repertoire. And so the music moved to downtown Morgantown for a post game jam session. Wet weather and logistics held down the crowd at this finale, but nothing dampened the music as the old stagemates hit a few final licks before heading north and south, respectively.

To those who missed it, well, you missed it.

This was not Lawson's first time in front of a microphone.

Association Notebook



C.E. "Jim" Compton

Two prominent members of the Association received high honors this fall.

C.E. "Jim" Compton (left) was named by West Virginia University as this year's "Most Loyal Mountaineer." Jim, a staunch supporter of programs throughout the University, was singled out specifically for his leadership contributions in health, nutrition, and cancer research.

Lawrence Streets (right) was the co-winner of the Outstanding Reclamation Award presented by the Maryland Coal Association. His Allegheny Mining Corp., which does tremendous work on both sides of the Maryland West Virginia border, was appropriately honored at the annual meeting of MCA at the Lakeview resort in Morgantown.

The honors accorded these longtime cornerstone members of WVMRA are symbolic of the exemplary performance of Association people, both in the field, and throughout the state community. Congratulations to them.

Lawrence Streets

CALENDAR

JANUARY

9-10 13th Annual West Virginia Surface Mining Symposium, Charleston House Holiday Inn, Charleston, contact Patty Bruce, West Virginia Mining & Reclamation Association, 1624 Kanawha Blvd. E., Charleston, 25311, (304) 346-5318.

23-26 Semiannual Meeting, West Virginia Mining and Reclamation Association, PGA Sheraton, West Palm Beach, Fla., contact Patty Bruce, WVMRA, 1624 Kanawha Blvd. E., Charleston, 25211, (304) 346-5318.

FEBRUARY

3-4 "Coal Liquid Mixtures," Tampa Marriott Hotel, Tampa, Fla., contact Anne Phelan, Conference Coordinator, **Coal Outlook,** 1401 Wilson Blvd., Suite 910, Arlington, Va., 22209, (703) 528-1244.

4-6 Workshop, "Use of Microcomputers and Programmable Calculators to Plan Grading Operations and Estimate Reclamation Costs for Active and Abandoned Mine Lands," Montana State University, Bozeman, Mon., contact Dr. M. Douglas Scott, Reclamation Research Unit, Montana State University, Boseman, Mon., 59717, (406) 994-4821.

25-27 1986 Bulk Transportation Policies Seminar, Hyatt Regency Hotel, Lexington, Ky., contact Tina Hochberg, National Coal Association, 1130 17th St. NW, Washington, D.C., 20036, (202) 463-2629.

MARCH

13-14 1986 Kentucky Mining Workshop and Exhibition, Lexington, Ky, contact Geaunita Helfenberger, University of Kentucky, OISTL, 310 Bradley Hall, Lexington, Ky 40506 (606) 257-2820.

17-20 1986 National Meeting, American Society for Surface Mining and Reclamation, Holiday Inn Downtown, Jackson, Miss., contact Bill Plass, Executive Secretary, ASSMR 21 Grandview Dr., Princeton, 24740, (304) 425-8332.

27-28 Seventeenth Annual Conference on Erosion Control Practice and Research, "Erosion Control — Protecting Our Future," Dallas, Tex., contact Carol Forrest, IECA Program Chairman, Woodward-Clyde Consultants, 3467 Kurtz St., San Diego, Cal., 92110, (619) 244-2911.