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1. Prime Farmland Rehabilitation in Illinois and Indiana

Illinois coal basin contains abundant bituminous coal reserves that can be reached by surface mining operations around the rim of the basin (SW Indiana, W Kentucky, and southern and western Illinois) and by deep mining operations in central Illinois. Indiana and Illinois also contain loess, glacial, and lacustrine soils that are among the most productive cropland soils in America. This set up a major resource conflict between coal miners and farmers which came to a head in 1977.

Environmental and agricultural leaders proposed national legislation that would prohibit coal companies from mining on prime farmland until the mining companies could prove that crop production would be fully restored following mining. Since all Midwest surface mines contain some prime farmland, prohibiting mining would have shut down all surface mining operations and not allowed the critical time needed to develop the technology to move corn fields and to fully rehabilitate crop production.

Federal Surface Mining Control and Reclamation Act (SMCRA) was passed August 3, 1977. The law took effect in 1978 and was fully implemented by 1982. It allows mining of prime farmland, defined as USDA land capability class I and II, and includes most farm fields in crop production on slopes less than 6%. Mining companies have to demonstrate in their permit application that their mining method can restore 100% crop productivity in a reasonable amount of time.

The technology to move farm fields and fully restore crop productivity did not exist in 1977. Moving the soil was not the problem, but moving it so that crop productivity could be restored to pre-mining production levels was the challenge. The mining industry joined efforts with university and regulatory personnel to develop methods of moving and rehabilitating soils so that the coal mining would truly be a short-term land use. Harvesting the coal by surface mining would take land out of agricultural production for 5 to 10 years, but the ability to raise crops on the rehabilitated farm fields would be fully restored by the mining company. Bond posted by the coal company when the mining permit is issued is not released until crop production has been restored to the pre-mining yield capability.

When SMCRA was passed, many said that crop production could not be restored on the high-yielding soils of central Illinois, and there was little evidence to support the ability of the coal industry to rehabilitate crop fields. Compaction was quickly identified as the key soil issue. Where soil compaction could not be avoided, it would have to be mitigated by deep ripping with specialized equipment.

Since SMCRA was enacted, Illinois coal miners have met the crop standard on 23,000 acres of prime and high capability cropland. Indiana miners have met the standard on 24,383 acres

of prime farmland cropland. Rehabilitated prime farmland looks so similar to unmined farm fields that many cannot tell which fields have been surface mined for coal recovery.

Key to cropland reclamation is good pre-mining characterization of the physical and chemical properties of the soil resources and identification of the most suitable soil horizons for use in rehabilitation. Topsoil is typically the best soil horizon to return to the surface, due to favorable seedbed physical and chemical properties, as well as the higher organic matter content. Subsoil is often not the second best horizon for use as rooting media. The B-horizon can be very acid and have undesirable fragic soil properties. Where loess is available in the profile beneath the subsoil, it is frequently the second best soil material. The hydraulic excavator operator can blend a more desirable soil by mixing the acid subsoil with the underlying neutral loess. The resulting soil mix provides a more favorable rooting media for the rehabilitated cropland fields.

Equipment – When SMCRA was passed in 1977, the coal industry did not have suitable mining equipment to selectively move and replace soil horizons. Draglines and stripping shovels could move large quantities of overburden at very low cost, but the equipment could not selectively load and place just the soil horizons. The one exception was the cross-pit bucketwheel excavator and belt system, but it, too, is no longer used because it was not flexible enough for most mining reserves.

The initial prime farmland reclamation was attempted using large scrapers that were available from equipment manufacturers when the law was passed. Twin-engine (CAT 637) scrapers are suitable for building roads, but they are certainly not good for rebuilding cropland fields. It quickly became obvious that tire traffic from the heavy scrapers caused the subsoil to be compacted, and the dense soil did not allow good root development. The resulting shallow-rooted corn was susceptible to drought stress during hot spells between rains, and the crop yields were reduced.

Compaction caused by twin-engine scrapers

Pan scrapers have reduced compaction issues

Conventional farm tillage equipment could loosen compaction in the top 40 cm, but the scraper-placed soils had severe compaction to 1.2 meters. Specialized deep tillage equipment was developed to loosen compaction to 1.2 meters so that the crop roots could explore the full depth of the replaced soil profile.

Mining equipment has changed since SMCRA was passed. Large draglines and stripping shovels no longer handle soils, and large scrapers are gone. Soil haulage is done by trucks

and small pull-type scrapers. Hydraulic excavators selectively load trucks out of the soil bench on the highwall, with the loader operator telling the truck driver where to place each load. Pre-mining topsoil is often windrowed and loaded for placement into storage piles or direct placement on replaced rooting media. Subsoil and loess to a depth of 3 meters are loaded by the excavator for placement as rooting media on the graded rocky spoil. Keeping truck traffic on rocky spoil and dumping the full thickness of subsoil avoids compaction, so full thickness tillage equipment is not needed.

The interface between the replaced topsoil and rooting media can be reached by conventional agricultural tillage equipment to loosen compaction. The ideal slope for rehabilitated cropland is 1 to 4 percent. Some slope is needed to work out micro-settling issues that appear due to spoil settling in the first few years following reclamation. Contour terraces are needed as the slope increases to reduce the slope length and to help control erosion on the farm fields.

The coal mining industry supported research by U. of Illinois agronomists to identify key issues with initial efforts to reclaim cropland. When miners converted to haul-back equipment that could selectively place the best soil horizons with minimal compaction, the rehabilitation of prime farmland became routine. The old adage that “a person who says something can’t be done is often interrupted by someone already doing it” applies. The coal industry went through a process to define the key issues and then changed material handling methods to avoid problems and achieve the goals set out by SMCRA. Coal mining in the United States is truly a short-term land use, generally less than 10 years out of crop production. The agricultural resource is preserved for use in food production for future generations while the energy resource is harvested to meet our current energy needs.