What's Cropping Up?

A NEWSLETTER FOR NEW YORK FIELD CROPS & SOILS VOLUME 3, NUMBER 4, 1993

Farming a Dirt Highway 2: How to Keep a Temporary "Dirt Highway" Permanently Farmable

John Lacey
NYS Department of Ag & Markets

Last winter, you met the pitfalls of transmission pipeline right-of-way techniques unsuited for Northeast farm soils. Here are the techniques that work for your land, when applied fully:

Demand a wide right-of-way

A "wide" (but temporary) construction/restoration right-of-way will help save topsoil and keep it farmable. A narrow 75 feet wide construction right-of-way, for a large, main-line project, only leads to serious long-term soil degradation. A wide right-of-way (approximately 100 feet) gives enough room to stockpile topsoil safely, at the outside edge, away from all other pipeline activity. It keeps the infertile trench spoil as well as the cut-and-fill spoil away from the topsoil. Cropland at road and stream crossings often needs even wider space (beyond 100 feet) due to specialized construction practices. As for the area temporarily out of crop production, you can collect full crop compensation for every season that it is tied up by construction or extended restoration, until the correct techniques are fully carried out.

Strip all the topsoil, so that the only "dirt highway" is the subsoil.

Before ANY cut-and-fill grading begins; before ANY trenching begins...strip off ALL topsoil, as deep as it runs, for the ENTIRE construction, travel, excavation and spoil storage width of the right-of-way! *Not just the loam from the top of the trench?* No. Everything across the work portions of the right-of-way; right down to the subsoil horizon identified by a distinct change of soil color, or else down to the surface of a heavy concentration of stones under your plow layer.

DO NOT allow any pipe convoy traffic or trenching equipment over the "dirt highway" before your topsoil is peeled off of the entire "trenching-construction-travel" corridor and stockpiled in a berm (with occasional gaps for the surface runoff to outlet) at the extreme outer edge of the right-of-way. ***The pipeline agent says partial right-of-way stripping of topsoil has been used for other pipeline corridors through farms.*** Partial stripping means absolutely no protection of topsoil from construction traffic! Partial stripping merely means peeling the loam off only one-third (the trenching side) of the right-of-way while leaving the same thin layer of unprotected topsoil in place on the construction-and-traffic surface of the other two-thirds of the right-of-way. Thus, in our humid climate, the remaining topsoil is abused each month it is used as the construction convoy's "dirt highway" from heavy compaction followed by deep rutting and particle displacement with the clays, gravel and rocks"!

Give the pipeliners ample area -- a wide temporary right-of-way, to protect the fully stripped and stockpiled topsoil. The berm of fertile topsoil material should be bulldozed to the side of right-of-way farthest away from the line of trench. (This assures that the loam will be totally segregated from the spoil materials sorted on the trench side of the right-of-way.) Then, let the pipeliners do all the soil rutting, compacting and churning they want, rain or shine, but ONLY on a "dirt highway" of exposed, infertile subsoil, not topsoil! Demand the same method -- total topsoil stripping -- if your cropfield is to be used as a temporary pipe and construction equipment "yard".... Continual yard use will render the same damages similar to those on the construction right-of-way unless the topsoil is protected by complete stripping and stockpiling.

SOIL MANAGEMENT

Farming a Dirt Highway 2: (continued)

Get Everything in Agreeable Writing...First

"Talking" with a pipeliner about the soil protection standards necessary to keep your land farmable does not "assure" good restoration. And simply referring to the talky-talky, unwritten promises you've heard from a string of right-of-way agents (back during the "sign-the-easement" phase), won't work for you if you have to register a formal complaint or file a legal suit for shoddy restoration. Any "agreement" is (at least) a two-way process; not one-way. Review your draft, carefully. Make sure that the complete details of total topsoil protection and land restoration are clearly and fully written into the right-of-way document...before you agree to sign it; and, if applicable, before you endorse an "easement option" agreement.

Keep a record of seepage locations

During the open-trench phase, observe and keep a record of where the underground seeps drain in, along the walls of the trench. ***Why?*** On slopes, the backfill around the impermeable pipe becomes a large, crude "French drain", creating "water-boils" or deep, soupy wet areas, downhill, at breaks of slope. On the flatter terrain, in tighter subsoils, the refilled trench becomes the "basin" for the soil-water and can result in broad areas of chronic saturation. Make sure the pipeline company will have a proficient drain tile contractor come in, after the other work, and install intercept-tiles to correct the wet spots. Have the tile installed beyond the actual right-of-way, if necessary, to carry the drain line to an adequate outlet.

Trench Backfill

After the welded pipeline is lowered into the trench, backfilling begins. Usually the trench spoil materials are returned as backfill. To avoid abrasion from rocks, a "backfill-padding" machine sorts the spoil material allowing the finer sized materials to "pad" the pipe before the larger sized materials are returned. Your topsoil berm is "off-limits" and shouldn't be swiped as a source of padding material.

Make sure that concentrations of sorted rock material are not backfilled to the top of trench. The upper level of trench, for the final one to two feet, should be filled with subsoil up to the exposed (stripped) right-of-way surface. By avoiding rock overfill of the trench, you help prevent damaged farming implements later on; and, you lessen the chances for long term frost-heaving of rocks across the field.

Use a Camera

Keep a photo record of the topsoil depth, topsoil stockpiles and areas of excavated rock debris and the depth of the pipe below the surface cut. (The minimum recommended depth-of-cover over pipelines through tillable lands, free of shallow bedrock, is 48 inches.) Also, be sure and take pictures of the restoration work. Good photographs are inexpensive proof, and like the saying goes: "A picture is worth a thousand words".

Decompact -- Two Times -- Once Before, and Once After Topsoil Is Replaced

The exposed subsoil is more severely compacted by serving as the "highway" for the duration of pipeline traffic and construction work, than it will ever be from years of normal farming. But -- its not the topsoil. Its the infertile material. Once the trench has been backfilled with spoil material and the battered right-of-way has been rough graded, after the convoy and construction travel has ceased on your section, the subsoil must be decompacted TWICE -- once before any topsoil is replaced to "uplift" the embedded rocks, and once after the topsoil is replaced to achieve actual subsoil "shattering" with the proper implement.

First decompaction...ripping/chiseling to remove rocks

A tool commonly used by pipeliners is the wide-spaced 3-shank ripper, mounted on a grader or a bulldozer. The wide-spaced ripper, serves a limited purpose...to help break apart the most densely "cemented"

Farming a Dirt Highway 2: (continued)

stretches of the "dirt highway". Although the 3-shank ripper with its 30 to 36 inches spacing makes three defined fractures through the dense material, there is seldom any real subsoil-shattering (for root penetration) between the shanks, and only minimal rock separation. The chunks of ripped subsoil with "cemented" rocks are often larger in size than two big "shoe boxes". Any use of the 3-shank ripper MUST be followed with deep, multiple passes of heavy-duty chisel plowing. That way, the majority of the excess rocks which were redistributed from the cut-and-grading materials or from trench spoil materials and embedded into the "dirt highway", will be brought to the surface of the exposed subsoil.

Stones more than 4 inches in size, which were not originally part of your soil, do not belong in the upper subsoil, for future frost heaving, on a properly restored right-of-way. (In specialty croplands where stones are routinely picked, the size should be even smaller.) With repeated chisel plowing of the exposed areas of traffic, construction and refilled trench, the oversize stones can be brought up to the surface of the uncovered subsoil. The pipeliner should provide a mechanical stone picker, making repeated alternating trips between passes with the chisel plow. A labor crew should follow to pick, by hand and shovel, all oversize rocks missed by the mechanical picker. Watch out for excess moisture. Chisel plowing and mechanical stone picking should only take place when soil moisture permits, to help reduce the recompaction of the subsoil.

Replace the topsoil

Once the exposed subsoil is ripped and deep chiseled and the rocks are removed, don't allow any traffic on it... except for a small size, wide-track bulldozer (e.g. D-5) for spreading the stockpiled topsoil back over the right-of-way...when the subsoil moisture is relatively low. If it is too late in the year and seasonal soil moisture is too high, don't allow bulldozing of the loam over the wet, infertile subsoil! The loam will only be mashed down into it and lost. Delay restoration work on the "dirt highway" until the lower-moisture part of the next season while collecting crop compensation for the extended temporary loss of the crop acreage. It's a lot better than losing the soil's productivity and cropability level for a long, extended period or permanently.

Second decompaction...actual subsoil shattering

A deep subsoiler with auto-reset L-shaped legs, and adjustable leg spacing, as narrow as 20 to 24 inches (e.g. the Paratill and Paraplow) is the key implement for the required specialized decompaction after major rock removal and topsoil replacement. The deep fracturing L-shaped legs, pulled with 50 hp per shank, will effectively "shatter" the subsoil, at the critical root zone, as well as provide one final uplift of remnant oversize rocks to the topsoil surface for easy disposal. The 4-shank L-shaped leg implement, using a modified shattering plate connector, can withstand heavy use in our glacial soils. Again, make sure it is used only during conditions of relatively low to moderate soil moisture to achieve actual shattering.

Test the soil; and don't use the land as a "highway"

Once the soil resource of the right-of-way has been re-established --i.e. the subsoil is deep-ripped and the uplifted rocks are removed, the topsoil is replaced and the soil profile is thoroughly shattered in the subsoil layer with a deep L-shaped leg subsoiler -- keep all traffic off of it! The soil should be tested for nutrients and be limed and fertilized, at the pipeline project's expense. Your part of the pipeline right-of-way has done its share of work and is now restored! Its no longer a highway. Its part of the farm again.

You can contact John Lacey at (607) 255-1756.

CROP MANAGEMENT

Summer Seeding of Perennial Forages

Jerry Cherney
Soil, Crop and Atmospheric Sciences

Some spring forage seedings that were planned were never seeded. Some spring seedings failed. This means more summer seedings will be attempted this year. Each region of the country has its own philosophy concerning spring vs. summer seedings based on research results. Each individual farmer has his/her own opinions on the subject based on past experiences.

Recommendations Vary

According to the Alfalfa Management Guide, authored by Minnesota and Wisconsin forage specialists, a spring seeding of alfalfa is preferred in northern states because of greater chances of success. Similar recommendations are found in the Ontario Field Crop Recommendations publication. An alfalfa seeding guide published by the Certified Alfalfa Seed Council places equal emphasis on spring and late summer seedings. The "Southern Forages" textbook indicates that late summer is the correct time to seed alfalfa in the South.

Recommendations for perennial grasses, such as reed canarygrass, also vary. The "Forages" textbook indicates that both spring and late summer seedings of reed canarygrass are acceptable. According to one Minnesota forage specialist, reed canarygrass establishment is most successful in late summer, when weeds are less of a problem for weak reed canarygrass seedlings. In Indiana, a spring seeding of reed canarygrass has the greatest chance of success.

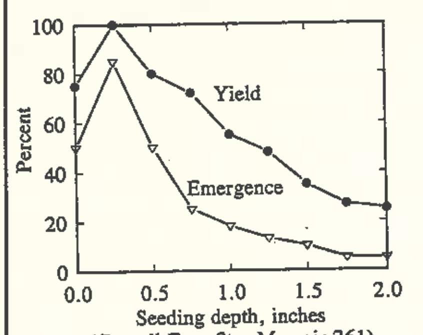
What should we do about forage seedings in New York State? National guidelines for forage establishment are not of much use to New York farmers, and guidelines from other states are also of little benefit. On average, New York's environment differs substantially from most other states, including most of Pennsylvania. Adding to this are drastic differences in the environment due to changes in elevation and slope. Forage seeding recommendations should be developed for each individual field that consider the forage species, soil type, soil moisture, and drainage, as well as topography and elevation.

In general, summer seedings are likely to have less available moisture. Forage dry matter yields may be lower in the seeding year compared to spring seedings, and may also be lower in the year following seeding. On the positive side, summer seedings can follow other crops, have less weed problems, and may be more manageable from a time and labor viewpoint. If seedings were planned for this spring, or if seedings failed this spring, then late summer seedings are a must.

Maximize Success

Moisture is one key to a successful summer forage seeding. If land is idle during the summer, the seedbed should be prepared in early or mid summer to allow for moisture conservation. Another moisture-conserving option is to eliminate weeds with a herbicide, followed by a no-till seeding. The advantage of being able to grow a crop prior to a late summer seeding can end up a severe disadvantage if that crop removes all available moisture from the soil profile. Likewise, a small grain companion crop is not recommended with a summer seeding, because of the competition for moisture.

The second key to a successful summer seeding is depth control (Fig. 1). Seeding depth should be 1/4 to 1/2 inch on heavy soils and a little deeper on sandy soils. If soil moisture is low in late summer, a 1/2 inch depth on heavy soils may be more desirable. The most common cause of seeding failures related to planting technique is placing seed too deep.



(Cornell Exp. Stn. Memoir 261)

Seeding date varies by species and location. Most forage species, need 6 weeks of growth in the fall before a hard freeze. Reed canarygrass and birdsfoot trefoil

(See Perennial Forages, pg. 7)

Rapid Movement of Manure to Tile Drainage Lines: Should We Be Concerned?

SOIL MANAGEMENT

Harold van Es, Soil, Crop and Atmospheric Sciences
Larry Geohring, Agricultural and Biological Engineering

"Contaminated tile flow is primarily associated with the application of liquid manure and may occur within a few hours after application"

The movement of agricultural contaminants to surface or groundwater has become an increasing concern. Surface water supplies such as streams, lakes and water reservoirs are primarily affected by runoff and erosion, while groundwater is threatened by leaching through the soil profile. Subsurface drainage lines play a distinctive role in the movement of water because they capture shallow groundwater which is then discharged into ditches and streams, thus providing for a hydrologic shortcut. Recent research efforts have characterized the potential for water and contaminant movement to drainage lines and evaluated the effect of factors such as water application rates, soil water conditions and soil incorporation. Based on these results and those of other studies, some general conclusions can be made about the potential for manure losses to tile lines.

Manure Losses

In New York State, many acres receive manure and concerns exist about the losses of phosphorus, nitrogen, pathogenic protozoa and bacteria. Phosphorus and nitrogen additions to lakes or estuaries may cause excessive growth of aquatic plants. Some pathogenic protozoa are of concern for surface drinking water supplies, and bacteria may affect recreational water use. Much of the annual manure losses are associated with runoff from barnyards and fields, especially during winter and spring when soils are frozen or saturated.

Manure movement to subsurface drainage lines has also been reported. In such case, tile water flow appears dark and cloudy and may have an odor. Contaminated tile flow is primarily associated with the application of *liquid* manure and may occur within a few hours after application. Such rapid downward movement of manure is attributed to the existence of "preferential flow paths" in soil which allow the slurry to move through large and continuous pores, thereby bypassing the bulk soil. Such pores are associated with cracks, worm holes, old root channels and natural aggregation of soil material. Little quantitative information exists on the relative magnitude of manure losses to drainage lines compared to surface losses through runoff and erosion.

Factors Affecting Manure Losses to Drainage Lines

Research has shown that tile losses are affected both by manure properties and the soil conditions at the time of application. Concerns primarily exist with manures of high water content. An Ontario study reported on twelve liquid manure spreading events, eleven through irrigation and one through tank spreading. Eight events resulted in drainage water contamination within 20 minutes to six hours following manure application. Bacterial counts in tile water increased 750,000 fold in one instance. In some cases, tile flow from subsequent rainfall was also contaminated.

Several in-depth studies on the movement of water and contaminants to drainage lines were conducted on a clay loam soil at the Cornell University Research Farm near Willsboro, NY. These involved the application of chemical tracers on the soil surface which were followed by water application through irrigation. From this, the following can be inferred about the movement potential of surface-applied compounds (manure in this case) to subsurface drainage lines:

1. Tile line losses are smaller when application occurs on dry compared to moist or wet soil, even if the soil has shrinkage cracks. In dry soils, liquids move more readily into the bulk soil rather than travel through large macropores, thereby reducing tile flow and storing the potential contaminant in the soil matrix. Application of manure on moist or wet soils may therefore increase the potential for movement to drainage lines.

2. Tile line losses are generally reduced when water application rates are lower. This implies that losses are reduced when (i) lower quantities of manure are applied

(See Manure, pg. 7)

CROP MANAGEMENT

RESOURCE INVENTORY: I. Soil Survey Databases for Watershed Planning

S. DeGloria
Soil, Crop and Atmospheric Sciences

Soil information is used for a variety of land management and planning programs. Most applications have focused on the use of soil survey information for conservation planning on individual farms and fields within a county or watershed. The source for this information is generally a county-wide soil survey which provides descriptions of the soils that occur in various landscape positions for a given land parcel. The soil information is published in a report that contains a narrative describing the natural setting and general characteristics of the soils that occur in the county, laboratory data for selected soils, interpretations of soil behavior under selected land use practices, and detailed maps showing the spatial distribution of soils throughout the area of the survey.

Recently, concern for conservation planning at land parcel and watershed scale has stimulated the development of computer-based methods to integrate soil survey information with other environmental data and mathematically- or statistically-based models of soil processes. In response to the need for soil information in a computer-compatible format, the USDA-Soil Conservation Service has developed three soil geographic databases for understanding and using soil information at different spatial scales.

The most detailed level of soil information is that contained in a county-based soil survey. The computerized version of this county-based soil information is called the Soil Survey Geographic Database (SSURGO). Maps showing the distribution of soils and their associated descriptions of each soil have been computer-encoded so conservationists can more quickly generate soil interpretive maps for use by landowners or conservationists; or selected soil properties can be used in estimating pesticide and nutrient transport using simulation models, estimating soil erosion, or evaluating land for various agronomic, development, or conservation purposes.

A more general level of soil information generated on a state-wide basis is called the State Soil Geographic Database (STATSGO). This soil information is essentially an aggregation of more detailed soil information in which soils are grouped according to similar physical, chemical, and mineralogical properties. Conservation planning with this database can only be conducted over large watersheds or areas as large as individual states. Site- specific planning cannot be conducted with these data.

The most general level of soil information is contained in the National Soil Geographic Database (NATSGO). This soil information is only useful for resource appraisal, planning, and monitoring for regional land areas comprised of many states. Conservation planning with these databases for individual states, watersheds, or farms is not possible.

The major issue being confronted by soil and water conservationists is the accurate translation of the detailed soil geographic data from an analog, or paper map, form to a digital, or computer-compatible, form. These soil data are in more demand by the public in a digital form than are the other two more general soil geographic databases, most of which are already in a digital format because they are less detailed and cover a larger area. The translation of the traditional soil survey requires the original soil maps be (1) **recompiled** onto a suitable base map, (2) **digitized** so as to accurately encode all of the pedologic information contained in the original maps, and (3) **updated** to reflect recent changes in the classification of the soil, and new knowledge related to soil properties and behavior.

Soil maps from older soil surveys were published on photo basemaps that caused the location of soil boundaries to be displaced from their true plan position on the Earth's surface by a process known as relief displacement. Unless the soil boundaries on these older photo basemaps are redrawn on a planimetric basemap before digitizing, the inaccuracy of soil boundaries will be incorporated into any digital version of that map. The current policy is to redraw the soil boundary lines onto a basemap at a scale, accuracy, and level of detail similar to the original map.

(See Databases, pg. 7)

(Perennial Forages, from pg. 4)

both produce slow developing, weak seedlings and these species should be planted in late July to maximize success. Although most other forage species have more vigorous seedlings, it is still advisable to finish late summer seedings by August 15. High elevation and/or northern slope seedings should be made at least one week earlier than south slopes and/or valleys.

In recent years it has been very difficult to get a spring seeding in before May in New York State. This means an increased chance of failure due to lack of moisture, as in 1991. It increases the likelihood of severe weed problems, which can lead to stand failures. In some cases, forage seedings compete directly with corn planting for time and labor. Summer seedings are a reasonable alternative, if done correctly.

(Manure, from pg. 5)

(ii) manure is applied with lower water content (assuming the same amount of nutrients per unit land area), (iii) low irrigation rates are used. It is also speculated that instantaneous broadcast spreading with tank spreaders may result in greater tile losses compared to gradual application through low irrigation rates. If manure application is followed by rainfall, intensive storms will cause greater manure movement to drainage lines than gentle showers, given the same rainfall amount.

3. Soil disturbance, especially plowing, prior to or after manure application reduces the movement potential to tile lines. Tillage interrupts the continuity of macropore flow paths from the soil surface to the deeper layers of the soil. Macropore continuity is therefore greatest under no-till systems and in soils which have not recently been tilled. Soil incorporation after manure application also reduces the leaching potential during subsequent precipitation events (as well as the runoff potential).

In summary, the movement of manure to tile lines is an environmental concern, although limited quantitative information exists on its significance relative to manure runoff. These concerns are mostly associated with liquid forms of manure. Field application methods and soil conditions at that time can also affect the movement potential. Based on research results on tracer movement to drainage lines, we can make some general inferences about the effect of such factors. At this time, it is appropriate to be concerned about manure losses to drainage lines and evaluate manure handling and field application procedures relative to this problem.

(Databases, from pg. 6)

Once these lines of soil boundaries have been recompiled onto a planimetric basemap, they can be computer-encoded using a coordinate digitizer or similar device that creates a set of vertices (x,y coordinates) that collectively compose a line delimiting a soil map unit boundary. These vertices are stored in a computer file, and are used to recreate paper maps indicating the spatial distribution of selected soil properties or the capability of the soil map unit to support various land use practices.

Associated with the computer files containing the geographic locations and boundaries of soil map units, there are other computer files containing data and information on the nature of each soil map unit. These data are stored, retrieved, and analyzed using relational database management system (RDBMS) computer programs. The RDBMS allows the conservationist or landowner to sort the database using certain soil characteristics of interest to the user. These databases are constantly being updated to reflect changes in soil classification, or taxonomy, new laboratory results for selected soil properties, and interpretations of the soil's capability to sustain certain land and water management activities.

For those wishing additional information on the process of translating traditional soil surveys to computer-compatible forms, or on access to such digital soils information to help meet their resource information needs, please contact the Soil Information Systems Laboratory at Cornell University, Ithaca, New York (607 255 2278); or the Soils Staff, USDA-Soil Conservation Service, Syracuse, New York (315 423-5510). In Part II, we will explore how the digital soil information is combined with other environmental resource information to predict the leaching potential of pesticides and nutrients.

Calendar of Events

Oct. 4-7	Field Crop Dealer Meetings. Contact P. Kline 607-255-2177.
Oct. 17-19	Empire St. Chap. SWCS Annual Mtg., Bonnie Castle Resort, Alexandria Bay.
Nov. 7-12	Amer. Soc. of Agronomy Mtgs., Cincinnati, Ohio. Contact ASA 608-273-8080.
Dec. 2	Cornell Seed Conference, Site to be announced. Contact B. Pardee 607-255-1653.
Jan. 11-12	Empire State Soil Fertility Assoc., Inc. Meeting, Auburn Holiday Inn.

What's Cropping Up? is a bimonthly newsletter distributed by the Department of Soil, Crop and Atmospheric Sciences at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments at Cornell University: Soil, Crop and Atmospheric Sciences, Plant Breeding, Plant Pathology, and Entomology. **To subscribe, send a check for $8.00 along with the form at the right.**

What's Cropping Up? - Subscription

Name:

Affiliation:

Address:

City: State: Zip:

Make check payable to: **CORNELL UNIVERSITY**
and return to:

Department of Soil, Crop and Atmospheric Sciences - Extension
144 Emerson Hall
Cornell University
Ithaca, NY 14853

Cornell Cooperative Extension

Department of Soil, Crop and Atmospheric Sciences
144 Emerson Hall
Cornell University
Ithaca, NY 14853

Helping You Put Knowledge to Work