

Deep tillage will benefit compacted soils

"There was more deep tillage in Iowa last fall than expected and probably more than any other year in history," according to Stu Melvin, extension agricultural engineer at Iowa State University.

"Most of us who work in tillage education were surprised by the renewed enthusiasm for this practice, particularly when little research has been done in the Midwest in recent years to support deep tillage," he says.

Soil compaction problems have been discussed at hundreds of meetings and the media has covered the problem extensively. However, most of the information has been directed at causes of compaction rather than the value of remedial measures, such as deep tillage, the engineer says.

Research during the past decade has quantified the effects of soil compaction on crop yields on several types of soils in the Midwest. Much of this research has been aimed at the effects of subsoil compaction caused by heavy axle loads of 10 tons or greater.

The major impact on the physical properties of soils is that compaction decreases the large pores in the soil that provide air and water transfer, he explains. This affects drainage and aeration of the soil.

tion of the soil.

During the 1970's, farm equipment size and weight grew large enough to create compaction problems in soil below normal tillage depths.

Most research has shown that axle loads of less than 5 tons will not substantially compact soil deeper than 10 to 12 inches. However, if heavier loads are applied, particularly when soils are wet, compaction can be 2 feet or deeper.

Compaction varies with soil type. Effects are greater and last much longer on finer textured soils like clay and silty clay loam than on silt and silt loam soils of the Midwest, according to Melvin.

Yield losses the first year after compaction may be as high as 25 to 40 percent for fine textured soils. The long-term effects from a single compaction can last for 3 to 5

years with soils of high clay content in the subsoil. For soils with lower clay content, initial yield and long-term effects are lower.

Microbial activity, as well as the transfer of oxygen and carbon dioxide, also may be limited for good crop root environment. In addition, the strength of the soil may be increased to a point where crop root growth is restricted.

Recent Iowa studies show that spring tillage traffic can reduce corn yields. This effect is noticeable in many fields where spring tillage tracks are evident in the growing crop.

On one soil in the Mississippi River Valley, corn grown in tillage tracks suffered 13 percent yield loss when compared with corn in untracked areas.

Twelve different tractors

were evaluated — five wheel type and seven crawlers. The average yield loss was 20 percent within the wheel tracks for wheel tractors and 11 percent for crawler type tractors.

Since wheel tracks represent only a small part of a total field, this translates to total field crop yield losses averaging from 1 percent to more than 4 percent for each tillage pass before planting, depending on the tractor used.

Surface compaction can be serious for some soils if soil tilth is adversely affected following spring tillage operations. These effects usually are temporary, with little lasting effects following tillage and one year of weathering, Melvin says.

Weathering effects include freezing and thawing, wetting and drying, root growth and earthworm populations. Most research has shown that freezing and thawing affects only the upper 4 to 6 inches below the soil surface.

For heavier soils with high clay content, wetting and drying cycles appear to be more effective for opening deeper macropores (large pore spaces) in the subsoil, he says.

Most Midwest clay soils are expandable — they swell when they become wet and shrink as they dry. When

large cracks develop in the soil as plants extract moisture, such as this past summer, shrinkage cracks can be found as deep as 3 feet or deeper.

With prolonged air exposure, stable soil aggregates may form that do not completely close when they become wet, which leaves large pores in the compacted subsoil.

Roots tend to follow previous macropores and expand and stabilize the openings with time. Earthworms also may assist in opening macropores, especially in the surface soil layers.

Information is meager regarding the benefits of deep tillage in the Midwest, according to Melvin. Where soils have been compacted, deep tillage has been beneficial.

"However, where deep tillage has been done as a routine practice with little regard to previous soil conditions, not much information is available for Midwestern soils to either support or condemn the practice."

Deep cultivation between rows has been beneficial under irrigated conditions, but detrimental under dryland conditions in states west of Iowa, he added.

In-row ripping is a standard practice for many sandy loam soils in the Coastal Plains of the southeastern

United States. But true tillage pans exist there as a result of soil texture and lack of good soil structure. Most early research done in the Midwest before 1960 indicated little benefit of subsoiling.

The effects of both surface and subsurface compaction have been demonstrated by several studies in the Midwest. Compaction has become more of a problem as a result of large equipment and more time pressure to cover larger acreages with the equipment.

Research also shows that soils have a natural ability to recuperate after being severely compacted, but it may take the soil up to six years to return to normal. If done properly, deep tillage can minimize such compaction problems.

"Even though the fall of 1988 was a good time to perform deep tillage operations, natural processes would have left most Iowa soils in good tilth this spring as a result of the extreme drying depths in the soil profile in 1988," Melvin says.

Several research projects are being started to study the effects of deep tillage on crop yields, but information is too limited at the present time to make recommendations from this work, he adds.



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SOIL CONSERVATION 1989

REP works to preserve natural resources

DES MOINES — More than 99.9 percent of the prairie our ancestors found here has been destroyed, according to Ken Bruene, field representative for the Iowa Department of Agriculture and Land Stewardship.

For three years, 23 organizations have been working together to protect Iowa's natural resources, he said.

Together the organizations makes up the Iowa Resources Enhancement Program (REP) alliance, which has been working closely with two state agencies, the Iowa Department of Natural Resources and the Department of Agriculture and Land Stewardship.

According to Bruene, the departments of Natural Resources, and Agriculture and Land Stewardship have provided much information describing the condition of Iowa's natural resources and what it will take to protect, conserve, and wisely use these resources while REP has been actively raising funds needed to carry out protection plans.

"REP includes groups as diverse as the Sierra Club, the Iowa Conservation Education Council, the Iowa Natural Heritage Foundation, the Iowa Association of County Conservation Boards, the Iowa Association of Soil and Water Conservation District Commissioners and the Iowa Society of American Foresters," he said.

Following are some factors REP is considering as it

works to save and build up Iowa's natural resources.

- Iowa tops the list of states with erosion and non-point pollution problems, while state funding has decreased in the last few years.

Bruene defined non-point pollution as pollution "caused by the impurities accumulated in water from surface drainage such as urban runoff, pesticides, herbicides, insecticides, fertilizer, silt and livestock wastes."

- Nearly all of Iowa's original prairie has been destroyed; only one percent of the state's wetlands and 20 percent of its forests remain today.

- Eighty percent of Iowa's parks and park facilities were in place before 1940. Those dating back to the 1930s depression era are in disrepair.

- Compared with some other state programs, Iowa's state allocations to the Department of Natural Resources have decreased since 1983.

"The price of adequately protecting and enhancing our natural resources is not cheap, but we must consider paying it for the sake of Iowa's future generations," Bruene said.

Bruene said REP's goal is to secure about \$29 million yearly to help reverse the depletion of Iowa's natural resources and develop and enhance those resources.

The funding would be spent as follows:

- Soil conservation and water quality, \$8.55 million (29 percent).

- Land acquisition for conservation, recreation and preserves, \$6.55 million (20 percent).

- Recreation facility development, construction and utilization, \$8 million (27 percent).

- Land and resource protection, management and utilization, \$2.50 million (9 percent).

- Environmental education, \$1.59 million (6 percent).

- Research and demonstration, \$2.65 million (9 percent).

"If we are to pass on to the next generation a quality

of life with open spaces, forest and wildlife, quality fishing and abundant food at reasonable prices, we must pay the high cost of protecting Iowa's natural resources. Not meeting this challenge has an even higher price," he stressed.

Bruene urges those interested in helping REP work toward its goals in Iowa to contact a local REP member

or phone Bruene at (515) 281-5853. Bruene also can be contacted by writing the Iowa Department of Agriculture and Land Stewardship, Henry A. Wallace Building, Des Moines, IA 50319.

"Proper conservation and utilization of our natural resources in Iowa is the very basis of our standard of living as well as of our children's," he added.

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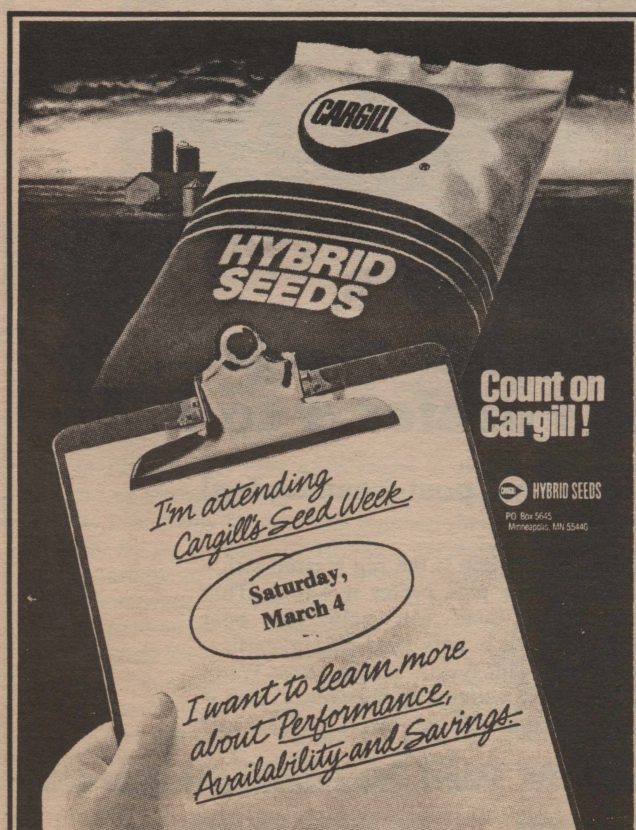
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Watch corn rootworms, spider mites in 1989

Rotating corn with soybeans has historically been an effective practice for escaping damage from corn rootworm larvae.

Since 1985, however, more fields of corn following soybeans in northwest and northcentral Iowa have had some degree of corn rootworm damage, reports Marlin Rice, extension entomologist at Iowa State University.

sity.

Close examination indicates that the problem is due to an adaptation in the northern corn rootworm life cycle that allows some of the population to survive in a corn-soybean rotation. This is known as extended diapause.

Extended diapause occurs when some of the northern corn rootworm eggs laid in

late summer do not hatch the following spring, but remain dormant in the soil and hatch in the spring of the second year. How extensive is the problem in Iowa?

During the summer of 1988, Iowa State University entomologists surveyed rootworm activity in 326 fields of corn that followed soybeans in this affected area of Iowa.

Eighty-nine of these fields did not have economic root damage. So chances for economic loss from extended diapausing northern corn rootworms is low. However, the problem did cause potential economic loss from root damage in 11 percent of the fields.

What should corn farmers do in 1989?

Farmers who have had corn following soybeans damaged by rootworms in the past, or who farm next to where such damage has occurred, should protect those specific fields with a rootworm insecticide either at planting or cultivation, Rice says.

"Applying an insecticide at planting time is not recommended where rootworm damage following a soybean rotation has not occurred in the immediate area," he says.

"This is especially true in eastern and southern Iowa where northern corn rootworms comprise a minor portion of the total rootworm problem.

"The western corn rootworm is the major rootworm pest in these two regions and the extended diapause problem has not been detected in this species," he added.

"Farmers who have not had rootworm damage where corn follows a non-crop host of those outside the area of the extended diapause problem should continue to be alert for lodged or goose-necked corn. When these symptoms are found in fields that are grown in corn every other year, the roots need to be dug up and examined to confirm that rootworm damage is responsible for the problem," he advises.

"In the final analysis, the decision to use a rootworm insecticide following a soy-

bean rotation should be based on the past history of the fields in the immediate area," he says.

SPIDER MITES

Twospotted spider mites were a major problem in soybeans this last summer.

Although spider mites do not cause widespread economic yield losses every year, according to Rice, they do have this potential if weather conditions favor population buildup.

Spider mites thrive during drought conditions and their populations literally explode, the entomologist explains.

During a summer of average rainfall, they are not a problem because rainfall indirectly reduces spider mite populations; not by knocking them off the leaves, but by producing environmental conditions that favors the spread of fungal diseases that kill the mites.

Another reason for this population explosion is that the beneficial predatory mites can't eat enough of the twospotted spider mites and reproduce fast enough to keep the twospotted spider mites from causing economic damage to soybeans.

So the question remains. Will we have another spider mite outbreak this summer?

"That depends partially on the weather. If we have another summer drought, then the odds favor a repeat performance of spider mites," Rice cautions.

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WATER LEVEL REGULATED — This structure was installed by Buchanan County on the pond at the Koutney Pond/Hoffman Woods located off Interstate 380, south of Brandon. The structure helps regulate the water level of the pond. Those involved in the building and design of the pond were the Soil Conservation Service, Buchanan County Road Department and Buchanan County Conservation Board.

Big Spring Basin demonstration project



**BY ROGER A. KOSTER
FIELD COORDINATOR**

Systematic monitoring of groundwater quality at the Big Spring Trout Hatchery and from tile lines, springs, wells, and surface streams in the Big Spring Basin (BSB) was initiated in the fall of 1981 and continues through today. The analysis of this water quality data shows that elevated levels of nitrate are widespread as well as some concern for pesticide contamination, with the higher levels of both in surface runoff waters and sediments.

In the 103 square mile Big Spring Basin in northwest Clayton County there are no cities or towns, no manufacturing plants or commercial industries, and no municipal waste treatment facilities. Water quality changes are associated with farming systems in the basin area. Corn, oats, and alfalfa fields, swine, dairy cows and beef animals dominate the terrain.

Big Spring is significant because it is one of very few places in the world that provides a natural field laboratory for the study of how surface activities affect groundwater; specifically farming activities. This unique geological feature means that nearly all of the groundwater within the basin exits at Big Spring, so scientists can easily measure how surface farming activities affect the quality of groundwater. By 1983 the citizens of northeast Iowa were well aware of the elevated levels of nitrate in their drinking water. Local citizens' groups began working with existing organizations and agencies to establish a working task force consisting of 13 federal, state, local and industrial organizations. As a result of the task force's efforts, an overall funding strategy was developed for a seven-year program. The program was designed to identify, demonstrate and encourage adoption of management practices to protect groundwater. Funding for the Project was approved by the 1986 Iowa Legislature, including on-farm field demonstrations of Best Management Practices to protect and improve groundwater, soils, surface waters and improve farm profitability.

EDUCATIONAL ACTIVITIES

Farm-to-farm surveys of the 229 residents in the Big Spring Basin were conducted in 1984, 1986 and 1987. The survey addressed the physical attributes of land used for crop and livestock management along with the attitudes of the citizens concerning groundwater quality. The survey provided an evaluation of the effectiveness of initial educational efforts by county and area extension staff, and others. The survey revealed:

- * In 1984 few farmers gave credit to alfalfa and animal manure as nitrogen sources for corn production;
- * By 1986 many farmers had reduced their nitrogen rates for corn by an average of 16 units per acre, primarily by giving credit to alfalfa and animal manure (additional reductions were noted in 1987);
- * 71 percent of the respondents stated that protecting water quality was a priority issue. Of the six issues that were posed to the respondents, water quality shared top rating with profitability in agriculture as the major concern;
- * 73 percent of the respondents stated that potential health risks posed by agricultural chemicals were a major concern on their farms. This compared to 51 percent who stated that they were very concerned about the issue nationwide and 65 percent who stated that they were very concerned about the issue in Iowa.

A part of the funding of the Integrated Farm Management Demonstration Program by the 1986 Iowa Legislature provided for an intensified educational effort in the Big Spring Basin by the Extension Service. During the crop year 1987 the following activities occurred:

- * A full-time coordinator was employed by Extension Service and located in Elkader;
- * Efforts to work one-on-one with 9 farmers in the 1,125-acre Bugenhagen subbasin continued. Activities provided for these farmers included sprayer calibrating, sampling for soil tests, record keeping for crop enterprises, tillage management assisting, pest scouting and managing services, and yield measuring for evaluating alternative corn production practices;
- * Field demonstrations were established for:
 - Alternative tillage management systems;
 - Time and rate of nitrogen applications;
 - Alternative herbicide and cultivation practices for weed control in corn;
 - Alternative rates of animal manure for a nutrient source in corn production;
 - Credit for alfalfa derived nitrogen in first and second year corn;
 - Pest scouting and management services;
 - Plugging of an abandoned well;
 - Field days for local farmers to view the demonstration plots and discuss alternative practices with campus and area based specialists.

"I feel that the field day we held was successful. And, I think that the people who attended felt that it was worth their time and effort," said Albert Hanson, a Clayton County farmer who has an Alfalfa Establishment and Maintenance Demonstration on his farm.

"I think that ISU is on the right track here because there are a lot of ways to raise crops without using harsh chemicals. And, until agricultural people start looking at the soil as a living thing and not just something to make a living off of they're going to be going against nature," said Gerald Fassbinder, a Clayton County farmer. "This is something that I'm glad to see ISU working on. But, it isn't something that can be done in a week. You need people who are dedicated to the project, and the Extension people are," said Phyllis Dettmann, a Clayton County housewife.

WHAT'S AHEAD

The demonstrations and educational activities conducted in 1987 will be continued through 1992. Additional efforts initiated in crop year 1988 included:

- * Alfalfa management activities showing seeding and establishment practices;
- * Expansion of manure demonstration plots and systematic sampling of soil water under the plots for nitrate analysis;
- * Ridge tillage demonstration with a herbicide interaction;
- * Annual surveys of land use, crop and livestock management practices;
- * Targeted soil sampling program for delivering nutrient recommendations;
- * Economic analysis of crop and livestock production demonstrations for documentation of energy savings;
- * Employment of a halftime communications specialist.

Data from these on-farm demonstrations is being collected each year. Results will be published as reliable information over-time is obtained. Most of these on-farm demonstrations take proven Experiment Station Research and apply it under on-farm field conditions with cooperating farmers. Field Days are held at the sites to show the yearly performance of the Best Management Practices. Information Boxes are located at the field sites for those who can not attend the Field Days or want to make a followup trip to the demonstration area.

You are invited. Not all of the Demos are in the BSB. Demo sites are located in eight northeast Iowa counties. Maps locating Demos can be obtained from your local Extension Service and SCS offices, or contact me at:

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