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The Potential Role of Cover Crops in Iowa Cropping Systems

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Introduction

Cover crops play an important role in crop management systems in many parts of the country; however, there has been little use of this practice in Iowa in recent years. Increasing concerns over the impacts of agriculture on the environment has caused a renewed interest in the potential role of cover crops. This paper will discuss potential benefits and risks of cover crops, and also discuss some of the systems currently being investigated.

Possible Benefits of Cover Crops

Soil Conservation. The traditional role of cover crops has been to minimize soil erosion. The need to implement Farm Conservation Plans developed by the SCS is one of the reasons for the renewed interest in cover crops. The use of cover crops would provide growers more flexibility in cropping strategies in many situations.

Nitrogen Management. Depending upon the species used, cover crops may contribute or immobilize nitrogen in the soil. Winter annual legumes, such as hairy vetch, may contribute between 50 to 130 lbs N/acre in southern regions of the U.S. Iowa's shorter growing season limits the growth of winter annual legumes, thus minimizing their role as a nitrogen contributor under typical production practices.

Non-legume cover crops tie up available soil nitrogen, rather than add nitrogen to the system. Winter rye may accumulate more than 50 lbs of nitrogen when used as a cover crop. Rye is being evaluated as a nitrogen trap crop in regions of the country with high concentrations of animal production that results in excess manure availability. It is hoped that the use of rye as a cover crop will reduce the potential for groundwater contamination by nitrates.

Weed Management. The use of cover crops is often cited as a potential means of reducing the quantity of herbicides used in crop production. Many cover crops have been found to reduce weed populations, either by physical mulching or through the release of allelopathic chemicals. An allelopathic chemical is a compound produced by plants that is released into the soil and is toxic to other plant species.

Although the use of certain cover crops may reduce the need for preemergence herbicides, many cover crop species must be killed or suppressed with a burndown herbicide in order to minimize competition with corn or soybeans. A heavy residue on the soil surface left by the cover crop may also interfere with mechanical weed control strategies, such as rotary hoeing or cultivation. Cover crops may have positive and negative effects on the weed management program.

Soil Tilth. The impact of cover crops on soil tilth is less clear than with other aspects of their use. Most cover crops are used in no-till systems. The additional organic matter produced by the cover crop, along with reductions in tillage, is assumed to improve soil tilth when compared to conventional tillage systems.

Potential Limitations of Cover Crops in Iowa

The majority of research and utilization of cover crops has been located in eastern and southern corn growing regions of the U.S. Due to differences in climates and soils between Iowa and these regions, it is unwise to take their results and assume that these systems will work in Iowa. Current research at I.S.U. should help provide better information on the suitability of various cover crop strategies for Iowa.

Soil Moisture. One of the major concerns with cover crops in Iowa is their impact on soil moisture reserves. Unlike areas where cover crops are commonly planted, Iowa typically is deficit in rainfall during the growing season to supply crop needs. Cover crops must be managed to limit their water usage; this can be achieved through species selection or management practices.

Growing Season. Iowa's short growing season is another limiting factor in the adoption of cover crops. The limited amount of growth generated in the fall by certain species may not provide sufficient ground cover to protect the soil from early spring rains. Hairy vetch and other winter annual legumes typically do not generate enough growth to contribute significant quantities of nitrogen. Current research is investigating the feasibility of establishing cover crops in the standing crop, thus effectively lengthening the growing season.

Cost. Another important factor that has limited the use of cover crops is the cost of establishment and management. Cover crops usually increase production costs without bringing a significant return at the end of the growing season in the form of higher yields. The major benefit of cover crops is improved soil conservation, and unfortunately the cost of soil erosion is frequently ignored when evaluating production costs. Direct costs incurred in the use of cover crops include: seed, $4-12/A; planting, $4-6/A; burndown herbicide, $8-15/A.

Possible Cover Crop Systems For Iowa

Rye. The rapid growth of cereal rye is advantageous since it provides excellent protection of the soil; however, this also is a drawback since rye can deplete soil moisture reserves. Aroostook rye is a variety developed in New England specifically for use as a cover crop. It has more cold-hardiness than grain types, thus it produces more growth in the fall. Figure 1 shows the impact of date of rye control on available soil moisture to the 5 foot depth at corn planting. Soil moisture levels were reduced more than 50% when rye was killed at planting rather than with earlier applications. Although early killing of rye conserves soil moisture, it may diminish the weed control benefit of the rye mulch (Figure 2).

Oats. There is considerable interest in the use of oats due to cost savings associated with this system. Many growers have a source of farm grown seed, therefore minimizing seed costs. The big savings would come in the elimination of the burndown herbicide application since oats are winter killed. Research at Iowa State University is currently evaluating effectiveness of different methods and timing of seeding on establishment of oats for use as a cover crop.

Hairy Vetch. Hairy vetch appears to be the legume best suited for use as a cover crop under Iowa conditions. Vetch lacks a strong tap root, thus it can be easily killed with light tillage. Due to the short growing season, growers should not expect significant nitrogen contributions from fixation. A drawback of hairy vetch is that it is an alternate host for soybean cyst nematode. Hairy vetch is often seeded in combination with a small grain to improve fall cover of the soil.

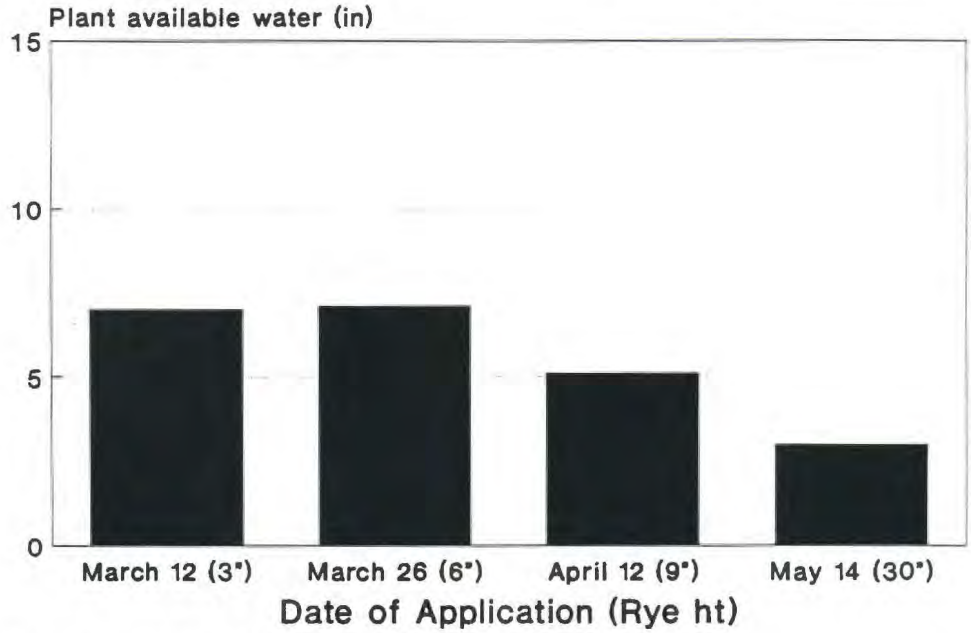
Other Species. Considerable effort has been made at adapting cover crop practices from other regions to Iowa's growing conditions. Researchers' also are evaluating other species that might better fit the needs for cover crops in the northern corn belt. A breeding project at the University of Minnesota is attempting to develop a mustard species with suitable cover crop characteristics. It is hoped they will be able to develop a variety with a short enough life cycle to eliminate the need for a burndown herbicide and allow the cover crop to produce sufficient seed to naturally restore the cover crop the following fall. This type research may hold the best promise at developing a cover crop system better adapted to our conditions.

Summary

Development and implementation of production systems that minimize soil losses will be a major emphasis during the 1990's. Cover crops can play significant roles in these conservation tillage systems. Although the majority of soils in Iowa can be

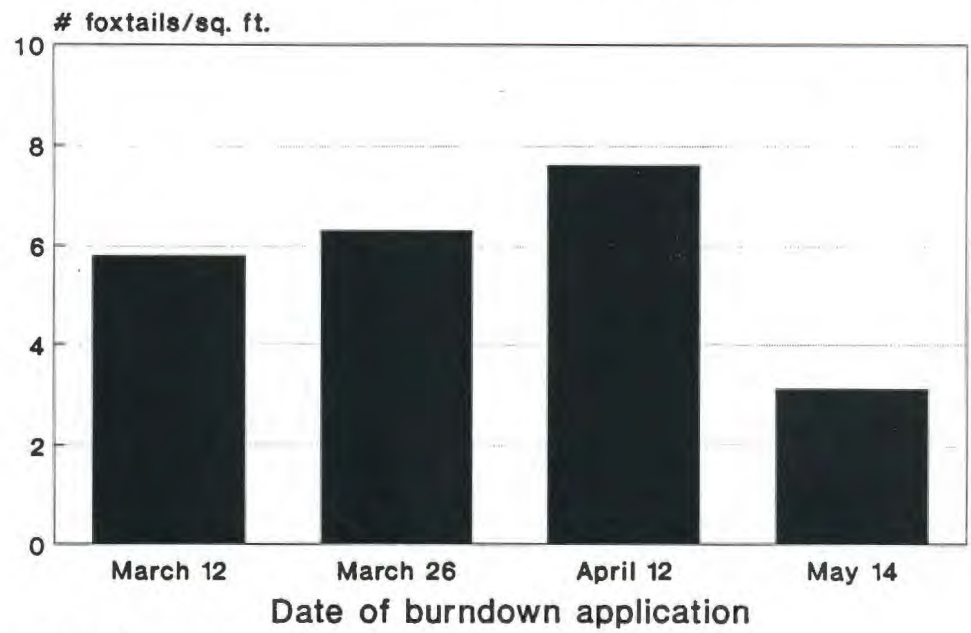
managed effectively utilizing reduced tillage, certain highly erodible soils would benefit from the addition residue provided by cover crops. Systems adapted from other regions of the country can be used in Iowa; however, current research looking at alternative cover crop species may lead to systems better suited to our growing conditions.

Figure 1. **Effect of date of rye kill on available soil moisture at corn planting.**



Moisture reading taken to 5 ft on May 14

Figure 2. **Effect of date of rye kill on foxtail populations in no-till corn (July 13).**



Hartzler. 1990. Castana, IA.