A Centralized Regional Database for Winter Cover Crops in Annual Cropping Systems

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Introduction

Winter cover crops have the potential to provide erosion protection, carbon sequestration, and N loss prevention in annual cropping systems in the Midwest. To realize the potential of cover crops to provide these environmental services it is important to develop location specific recommendations for cover crop management and reasonable predictions of environmental benefits. For example, what is latest fall planting date for a location and what is the predicted amount of N taken up by a cover crop planted on a given date? To accomplish this, the Midwest Cover Crops Council (MCCC) is proposing to establish a long-term centralized regional database with cover crop growth, management, and environmental benefit information collected from multiple past and present winter cover crop experiments, trials, demonstrations, and farmers fields across the region. Although initially the database will focus on rye cover crops, data on other cover crops species will be included as it becomes available. The database will be structured to allow for input of data from locations with comprehensive data sets and from locations with minimal information, including farmers fields. A primary use for this database will be as the data source for the MCCC Cover Crop Matrix, which is a decision aide for selecting cover crops and management approaches for cropping systems in the Midwest. Additionally, the data will be available to modelers for use in cropping system, watershed, or field models to predict environmental benefits of cover crops to soil, air, and water. Eventually, the database will be available to crop consultants, land managers, and NRCS and extension personnel to assist in designing conservation management systems.

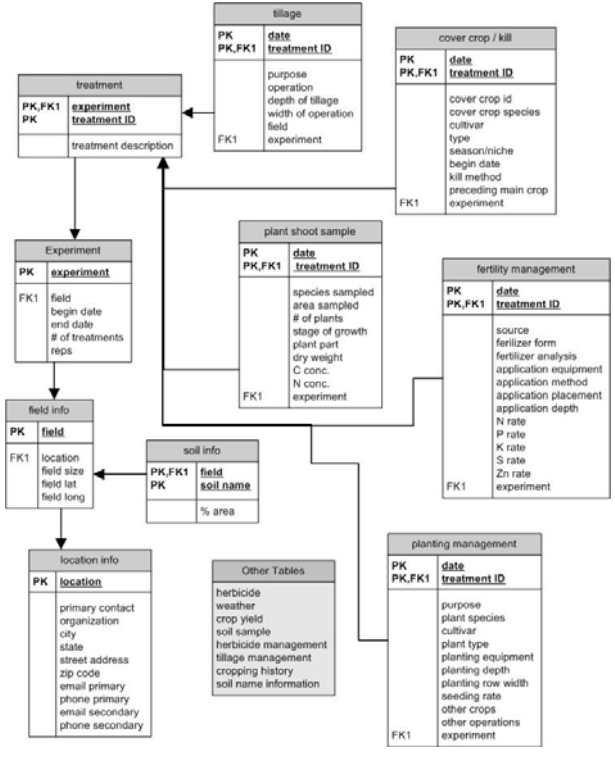
Objectives

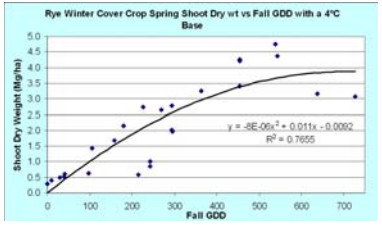
• Develop a preliminary database structure to obtain feedback from potential users and contributors.

• Present one possible application of data from the proposed database.

Materials and Methods

The database flowchart was prepared with MS Visio 2007, which has a database template. This template will be exported to MS Access 2007. Initially the database will be populated and tested with data from the Ames, IA location, which should reveal some relational problems. Data from other locations will be incorporated after feedback from other members of MCCC.





Discussion:

In simple terms the database is structured around tables (shown as boxes in the flowchart) that are related to each other through keys. A table consists of multiple fields (list in right column of flowchart boxes) that contain the individual data entries (which are not shown in the flowchart). For example the treatment table contains three fields: experiment, treatment ID, and treatment description. Each table has a primary key (PK), which is any set of one or more fields whose combined values uniquely identifies all individual data entries in a table. For example, the primary key for the treatment table is the combination of the experiment and treatment ID fields. Tables can also have a foreign key (FK), which is used to link two tables together. Typically, a primary key from one table is inserted into another table where it becomes a foreign key. As with primary keys, a foreign key can consist of one or more fields. For example, the foreign key for the planting management table is a combination of the treatment ID and experiment fields, which links this table to the treatment table.

The focus of the database is the treatment table. In this case, treatment is defined as the combination of a cover crop with particular set of tillage, fertility, planting, and cover crop kill management practices. Or a treatment may also mean a particular set of tillage, fertility, and planting management practices without a cover crop, if used for comparison. The experiment table is the first table above the treatment table in the hierarchy. Experiment in this table means any test, trial, demonstration, or formal experiment which compares or tests cover crops. The "experiment" in some cases may

Discussion (cont.):

have only one treatment, such as a cover crop grown in a farmer's field on a trial or demonstration basis. The complete hierarchy above the treatment table would be location – field – experiment – treatment.

Below the treatment table in the hierarchy there are numerous tables some of which we have just listed by name in the Other Tables box. These tables can be divided into management information tables and data tables. As I mentioned earlier, in some cases the management tables help to define the treatment. The data tables contain data from measurements or observations about the cover crops, soil, weather, main crops, or environmental impacts of the treatments for a given date.

The figure to the left is an example of how a cover crop database can be used to examine relationships between spring shoot dry weight of a rye winter cover crop and fall Growing Degree Days (GDD). The data consists of 24 field-experiment-treatment-date combinations from the Ames, IA location and the associated weather data. One potential use of the relationship shown in the figure would be to predict the amount of spring dry weight produced when a cover crop is planted on given day based on climate normals for the location. Obviously, other factors such as precipitation, initial soil water content, frost, and soil freezing will also impact winter cover crop shoot growth. But, the figure demonstrates the potential of examining these sorts of relationships over a wide range of conditions. We would assume that the insights into response of rye cover crops to fall GDD would be improved by including data from across the Midwest and not just from Iowa.

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