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Integrating sustainable concepts with the ISU Beef Feedlot Performance Projects Program

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Integrating sustainable concepts with the ISU Beef Feedlot Performance Projects Program

Abstract
Farmer-feeders who feed homegrown crops to feeder cattle as a marketing alternative for these crops must evaluate the impact of their cropping patterns and feeding on the whole farm operation. This project developed a tool for beef cattle producers to make more conscientious decisions.

Keywords
Animal Science, Animal management and forage, Economic and environmental impacts

Disciplines
Agriculture | Animal Sciences | Environmental Indicators and Impact Assessment

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Integrating sustainable concepts with the ISU Beef Feedlot Performance Projections Program

Abstract: Farmer-feeders who feed homegrown crops to feeder cattle as a marketing alternative for these crops must evaluate the impact of their cropping patterns and feeding on the whole farm operation. This project developed a tool for beef cattle producers to make more conscientious decisions—based on both profitability and sustainability—about the crops they grow and feed. The resulting Beef Feedlot Crop and Feed Planner uses specific farm data to generate an analysis that takes into account acreage, amount of production, feed usage, net inventory and its market value, and other factors, along with detailed cattle production and total cost data. The program provides operators with specific cost and return data, beef production projections on a per acre basis, and calculated soil erosion losses in tons per acre. This work signifies the first of a comprehensive array of whole-farm decision models.

Background
The beef cattle feeding industry has undergone remarkable changes in recent years. In the 1960s, the industry was dominated by farmer-feeders marketing fewer than 1,000 head annually. Although the number of producers raising significantly more than 1,000 head has increased, Iowa continues to maintain a significant number of smaller feedlots. These tend to be part of diversified operations in which crops grown on the farm are marketed through the livestock. Consequently, decisions that impact one facet of such enterprises will affect the others, and tradeoffs are sometimes necessary to benefit the overall operation.

Several software programs are designed to project performance and simulate the profit potential of cattle; these are based on weight gain, which in turn is based on anticipated feed consumption. Once costs are factored in, profitability can be estimated. However, feedlots that rely on homegrown feeds cannot rely on programs that are keyed to the net energy value and price of purchased feedstuffs.

Decisions about feeding programs and cropping patterns in farm feedlot operations are complex. Tradeoffs between enterprises require simultaneous evaluation of each along with the resultant net effect on the whole farm.

Programs such as FINPAC and PLANETOR have been widely used to look at the whole farm and to evaluate environmental impacts of management decisions. However, these programs do not address changes in cattle feeding programs and cropping decisions as they affect cattle performance and returns for farmer-feeders.

Cropping patterns and rotations can significantly affect overall farm profit and sustainability of the resource base. For this reason, and also because decisions about farm feedlot feeding and cropping are so complex, this project was designed to include concepts of enterprise budgeting and environmental impacts in a computer program that is highly sensitive and accurate relative to gain and efficiency simulation of feeder cattle.

In order to compete with larger, more specialized operations, farmers need detailed analysis and management capabilities that can be tailored to their individual enterprises. A view of the "big picture"—the net impact of an entire series of individual enterprise decisions on the whole farm—is essential to good management.

This work is designed for medium-sized cattle feeders who use cattle feeding as a marketing alternative for crops grown on their farms.
The program takes into account factors such as soil erosion potential, legume credits, tradeoffs between rotations versus continuous corn production, and other considerations specific to these types of operations.

The goal of this project was to develop a tool for farmer-feeders that provides sufficient information on profitability and sustainability for them to make conscientious decisions about the crops they grow and feed.

**Approach and methods**

The original goal of the project was to convert the existing Beef Feedlot Projections program to the C (computer) language and develop a complementary, integrated crop-decision program. Considerable progress was made, but problems associated with database sizes (for soil and cropping systems) impaired program performance. Commercial software upgrades occurring during the project period provided an opportunity to build into the program the flexibility of a spreadsheet for programming and subsequent updates along with macro programming capabilities that together resulted in a program with the look and feel of a Visual Basic Windows program, but with the flexibility and portability of a spreadsheet.

The availability of the Revised Universal Soil Loss Equation (RUSLE) and accompanying software also influenced the development of the BeefFeedlot program, as RUSLE assumptions were incorporated into the program to help account for crop cover management and support practices in addition to soil and climatic factors. The value in the RUSLE equation that represents erosion-control support practices includes practices such as terracing, strip-cropping, and contour farming.

A soil database (ISPAID) was sorted to include a file of soils specific to each county in Iowa. The files list the soil names for the county, texture and slope range, corn, soybean, oat, alfalfa, and bromegrass yield, and other factors. Rainfall is also specified for each county, and cover management choices include conventional, reduced, ridge-till, and no-till. Rotations are continuous corn, corn-soybean, corn-oats-meadow-meadow, corn-oats-meadow-meadow-meadow, corn-corn-soybeans, and corn-soybeans-oats-meadow-meadow.

Crop budgets comprise values for machinery used for each rotation/tillage method; although producers' own values should be entered when available, the default values for crop production costs have been selected realistically and are sensitive to the type of rotation (e.g., taking credit for legumes). All default values can be changed easily by the user.

Cattle gain projections, while based on an existing net energy system, have been modified to account for frame size of the cattle and Iowa conditions.

**Program use**

The software program produced in this project requires EXCEL 5.0. The by-county soil data need not be installed; the program prompts the user to insert the proper soils disk when new soil data are entered.

The Beef Feedlot Crop and Feed Planner is organized to allow the user to first describe crop production and costs, then cattle feeding programs, for an individual farming operation. Crop acreages with a similar predominant soil type and crop rotation should have similar inputs and can be entered as the same "field" regardless of location. Similarly, cattle that are fed the same feeding program and are of similar weight and type can be entered as the same "pen" regardless of location. Multiple "fields" and pens may be entered for the whole farm analysis.

The user needs to enter the following general crop and livestock information: predominant soil type, crop rotation, tillage and harvest methods and operations, custom rates or equivalents for tillage and harvest methods, crop yields, cash rent equivalent of land, initial cattle description (weight, sex, frame size), feeding program (feeds, supplements, energy levels), sale weights, and non-feed variable and fixed costs per day.
Once county, soil, and crop assumptions are entered in the program, the user is asked for information on crop rotation, acres, and cash rent, followed by harvest methods, which are important in calculating costs of production and inventories of various grains, silages, and hay available for feeding. The program calculates the number of acres available in any given year under each crop in the rotation. The user then specifies under each crop the number of acres harvested as grain, silage, ear corn, earlage, or hay. The total of the harvest acreage for each crop must equal the acres available.

Budgets for crop production are based on tillage and harvest practices used and a custom rate for each practice. Consequently, fixed and variable machinery costs as well as the labor involved in the operation should be included. After prompting the user for tillage method and conservation practices, the program selects a set of machine operations (that the user may customize).

Following completion of the Conservation Practices and Tillage dialog boxes (see Fig. 1), the Crop Budget/Tillage screen offers the user the opportunity to edit or view a printout based on the information entered. At this point, assumptions can be customized. Crop input costs (seed, fertilizer, etc.) are generated for each crop in a rotation on the basis of ISU Extension Farm Management crop budget estimates. These values can also be customized to reflect the individual farm operation (see Fig. 2).

The crop budget printout summarizes these inputs and costs from a given rotation or field. Costs are broken down within each crop, and per unit production cost is calculated.

Cattle input information is best entered by pen or by grouping cattle of similar weights, gender, and feeding program. Items include number of head purchased, feeding phases and type, price paid, and incoming and final pay weight, among others. At this point a feeds database may be edited to reflect changes in prices, costs, or nutritional values.

The Beef Feedlot Performance Projections printout projects in detail the cost and performance of a pen of cattle given the inputs specified. Categories within this printout include cattle type and consumption, financial, pay-to-pay cumulative performance, cumulative feed totals, performance (such as average daily gains, etc.), feed consumption, and cost. At this point the user can choose to generate a
The Whole Farm Analysis printout assimilates all information regarding crops and cattle to project the profitability and sustainability of an operation. Whole Farm Analysis or proceed to the crop and feed balance section.

The crop and feed balance screen shows the amount of production of each crop that has been entered in the crop input section. The amounts of home-raised feeds expected to be used are calculated to provide the net inventory (the difference between crop production and feed usage). This screen also shows the average soil loss of all crop rotations entered for production of these crops. At this point, the user can re-enter data to reflect a different scenario or view the Whole Farm printout.

The Whole Farm analysis (see Fig. 3) is the final result of the entry of crop and cattle production inputs for a specific farm. In it, the crop production section lists acreage, production amount, feed usage, net inventory, market value of inventory, and other information. The cattle production section shows purchase and sale weights and values, number of cattle fed, purchased feed amounts and costs, and non-feed costs. Total income is the value of cattle sold and the market value of crops in inventory. Total costs include all production costs, purchased feed costs, and non-feed cattle costs. Farm net returns are the difference between total income and total costs. Net returns are also expressed on a per head of cattle and per acre basis.

Also shown are beef production per acre and calculated soil erosion losses in tons per acre.

**Implications**

Although this project made significant progress, much potential remains for developing integrated whole-farm decision models. An extensive manure management module will also be integrated with this program, as will feed requirement and budgeting models for other livestock species and enterprises.

Extensive field testing of the Beef Feedlot Crop and Feed Planner has just begun through ISU Extension Field Livestock specialists, who will conduct one-on-one sessions with producers. The results of these sessions will be documented, and an evaluation will be conducted. The program’s impact will not be fully known until completion of the field test. However, the program is expected to help producers make more informed decisions about cropping practices and feeding programs that improve farm net income and the sustainability of the land resource.