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Iowa Cropping Practices, 1996

Michael Duffy
Iowa State University, mduffy@iastate.edu

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Crop production practices in Iowa are changing rapidly. New technologies and methods are being adopted with such frequency that it is difficult to ascertain current practices. This paper presents summary statistics and initial analysis from a 1996 cropping practices survey. The data were collected as an expansion of the USDA cost and return survey. The Iowa State University Leopold Center for Sustainable Agriculture provided the funding to expand the survey.

Farmers were randomly selected and the data was collected for one of their fields. The data presented are for 227 fields with corn following corn, 695 corn following soybean fields and 868 soybean after corn fields.

In addition to the 1996 survey, selected comparisons and references will be made to similar surveys conducted in 1989 and 1994. The 1989 survey summary can be found in the ISU Extension Publication FM1849. The 1994 survey is summarized in various USDA publications.

**Machinery Operations**

The number of trips across the field varied considerably by crop and farmer. The average number of trips for continuous corn fields was 8.6, ranging from 4 to 14. For corn following soybeans the average number of trips was 7.6 with a range from 4 to 12. Soybeans averaged 6.6, ranging from 2 to 12. Figure 1 shows the distribution of the number of trips by crop. Note that the majority of corn fields had between 7 and 10 trips while the soybean fields were almost equally divided between those with 6 or fewer trips and those with 7 to 10 trips.

Figure 2 shows the percentage of acres by primary tillage implements. Figures 3 and 4 show the percentage of farmers by the number of sprayer and fertilizer trips, respectively. Note that 85 percent of the soybean farmers reported no fertilizer trips.

The percentage of farmers using row cultivation has changed dramatically over the past seven years. Figure 5 shows the decrease by crop since 1989. The percentage of farmers row cultivating has decreased from 84 percent in 1989 to 49 percent in 1996. This change in row cultivation has been accompanied by a change in row widths. A more detailed discussion of the implications of these changes will be presented later in this summary.

No-till was used on only seven percent of the continuous corn acres. However, 20 percent of the rotated corn and 22 percent of the soybeans used no-till. The following discussion will only include rotated corn and soybeans due to the limited use of no-till on continuous corn. The no-till fields had no pre-plant tillage trips compared to an average of 1.6 and 2.5 pre-plant tillage trips for tilled corn and soybeans, respectively.

Figure 6 shows the average herbicide and total weed management costs by tillage and crop. The total weed management costs include herbicides, applications, and row cultivation costs. Note that the rotated corn showed little difference but that soybean herbicide and total weed management costs were higher for the no-till fields.
The average yields and return to management are shown in Figure 7. The return to management uses $2.60 corn and $6.80 soybean prices. The land costs are a function of the yield and the labor charges are a fixed amount per acre. The machinery cost estimates are from the ISU Estimated Costs of Crop Production publication, FM1712. On average the no-till yields were lower and this resulted in lower returns. Remember that this is a cross-sectional presentation and that individual results will vary depending on soil type and other individual considerations.

### Pesticides

Virtually every field reported using herbicides. The average herbicide costs per acre were almost identical $30.54 for continuous corn, $30.47 for rotated corn, and $30.64 for soybeans. The herbicide cost estimates used standard prices for the materials.

Broadcasting is the predominant method for herbicide applications. For corn, 91 percent of the applications were broadcast and 6 percent were banded. For soybeans, 90 percent of the herbicide applications were broadcast and 7 percent were banded. The remainder of the applications was spot or some other type of method.

For both corn and soybeans the applications were about equally divided between operator and custom applied. For corn 52 percent were operator and 47 percent custom applied. While for soybeans 56 percent of the applications were by the operator and 43 percent were custom applied.

Insecticides were applied on 65 percent of the continuous corn acres at an average cost of $14.22 per treated acre. Only 9 percent of the rotated corn acres received an insecticide application at an average cost of $13.62 per treated acre. For all corn, 20 percent of the acres received an insecticide application in 1996. Less than one percent of the soybean acres were treated with an insecticide in 1996.

### Fertilizers

The average pounds of nutrients applied per acre by crop are shown in Figure 8. The average nitrogen rate for continuous corn was 133 pounds per acre. For rotated corn the average nitrogen rate was 129 pounds per acre. For both continuous and rotated corn 98 percent of the acres had some commercial nitrogen applied. Only 17 percent of the soybean acres received any commercial nitrogen and the average rate was only 12 pounds per acre.

Slightly over half of the corn acres used anhydrous ammonia fertilizer, 54 percent of the continuous corn acres and 56 percent of the rotated corn acres. Anhydrous was 47 percent of the total commercial nitrogen applied to continuous corn and 46 percent of the rotated corn commercial nitrogen.

Phosphorus and potassium were applied to 98 percent of the corn acres regardless of the rotation. Only 17 percent of the soybean acres received commercial phosphorus and potassium.

### Seed

The average seeding rate for corn after corn was 27,272 kernels per acre. For corn after soybeans the average seeding rate was slightly higher at 27,936 kernels. The average seed cost was $26.23 per acre for continuous corn and $27.22 for rotated corn.

The average seeding rate for soybeans was 1.12 bushels per acre at an average cost of $17.89. Seeding rates and cost varied considerably depending on row widths. Differences based on row widths will be discussed shortly.
Yields and Returns

The average yield for continuous corn was 140 bushels per acre, ranging from 31 to 230 bushels. Rotated corn averaged 145 bushels per acre with a range from 48 to 224 bushels. Soybean yields averaged 46.5 bushels per acre. The range in soybean yields was from 10 to 72 bushels.

The cost for machinery operations and the price per pound for fertilizer are taken from the Iowa State Extension Service Estimated Costs of Crop Production. The total costs, without a land or labor charge, averaged $198.18 per acre for continuous corn, ranging from $91.17 to $282.52. The average costs for rotated corn were $194.10, ranging from $83.37 to $297.74 per acre. For soybeans the average costs without a land or labor charge averaged $104.42 per acre, ranging from $50.60 to $189.66 per acre.

Assuming a corn price of $2.60 per bushel and soybeans at $6.80, the average return to land, labor and management, per acre, was $166.21, $183.88, and $211.72 for continuous corn, rotated corn, and soybeans, respectively. A charge of $.89 per bushel of corn and $2.72 per bushel of soybean yield were used to estimate a land cost. The labor charges assumed were the average per acre charges reported in the Estimated Costs of Crop Production. Using these assumptions, the average return to management for continuous corn was $17.55, ranging from -$109.51 to $162.78. For rotated corn the average return to management was $33.43 per acre, ranging from -$143.35 to $198.73. Soybeans had an average return to management of $67.08, ranging from -$118.79 to $177.98 per acre.

Comparison of Different Row Widths for Soybeans

The most dramatic change that has occurred in crop production has been the shift in soybean row widths. In 1996, 34 percent of the soybeans were planted with 30-inch rows, 26 percent were drilled, 17 percent used wide 36 to 40 inch rows, and 13 percent had narrow 16 to 20 inch rows.

The change in row widths changes the entire production process. Drilled soybeans averaged only 1.1 pre-plant tillage trips, narrow row averaged 1.95, the 36 – 40 inch rows averaged 2.49 and the 30-inch row soybeans averaged 2.66 pre-plant tillage trips. The average number of row cultivations ranged from 0 for the drilled beans to 1.1 for the wide, 36 – 40 inch row soybeans.

Figure 9 shows the average seed cost, herbicide cost, and total weed management cost per acre based on soybean row width. The total weed management cost includes the herbicide, application, and the machinery cost for row cultivating.

The average yield and return to management are presented in Figure 10. The return to management is defined similar to the previous section.

Although this was a cross-sectional study and not a research study of row widths, the results shown in Figure 10 still raise the question why people are shifting to the drill and narrower rows since the 30-inch rows show the highest return. One reason is the time for cultivating. As noted, the narrower rows are cultivated less and depending on the opportunity cost for the labor saved individual farmers may arrive at a different conclusion than shown in Figure 10. It should also be noted that the shift to drilled soybeans appears to have stalled. In 1989 only 2 percent of the acres were drilled but in 1994 it was 27 percent and the results for 1996 are essentially the same as 1994.

The return to management varied by over $200 per acre for each of the soybean row widths. All of the row widths had some farmers that reported a loss. This illustrates not only the tremendous variability in returns but also that no one technology or row width is the best for everyone.
Impacts of Manure

One of the major issues facing Iowa agriculture is the proper use and handling of animal manure. Manure was applied to 46 percent of the continuous corn fields and 21 percent of the rotated corn fields.

Figures 11 and 12 show the yield and average commercial fertilizer use for continuous corn and rotated corn fields based on manure use. The Figures show that average yields were higher and commercial fertilizer lower on fields where manure was applied versus where it was not.

Individual research projects have compared manure and commercial fertilizer. The results shown in Figures 11 and 12 are consistent with those studies. The Figures also show that, in aggregate, Iowa farmers are accounting for at least some of the nutrient value of the manure. Further research from this and other studies is under way.

Energy Use

Energy use and the cost of energy have received considerable attention in the past and will likely be a major consideration in the future. Agriculture is not a major energy using sector in the US economy, but agriculture will be impacted by what happens to energy prices.

Fertilizer accounts for the majority of energy used in crop production. And, nitrogen fertilizer is the single biggest source of energy use in corn production, accounting for nearly 70 percent of the total energy use. Figure 13 shows the energy use by input category by crop. Fertilizer and pesticides have been converted to diesel fuel equivalents for ease of comparison. All of the categories shown in Figure 13 are derived from fossil fuels so the comparisons are for similar energy sources.

Figure 14 shows an estimated energy balance by crop. The yield has been converted to the energy in feed and further converted to the equivalent value in terms of gallons of diesel fuel. The purpose of this Figure is to show the energy intensive nature of the crop production practices in use today. The use of animal manure, discussed in the previous section, improves the overall energy balance through increased yields and decreased nitrogen fertilizer use. These improvements still do not produce a positive energy balance when the output is measured in terms of feed value.

Conclusions

Crop production practices in Iowa are changing rapidly as new technologies, techniques and materials are introduced. There still remains considerable variation in the practices that are followed. The shift in soybean row widths is one of the major changes that has occurred. Accompanying this change has been a change in the entire soybean production system. This change in row widths appears to be driven by time considerations more than per acre profit considerations.

The yields and total costs of production show considerable variation. Some of the variation is due to location and climatic conditions, however, much of the variation, particularly in cost, is due to the differences in production practices. The non-land or labor costs varied by over $130 per acre. Such cost variations lead to variations in returns of over $200 per acre.

Iowa farmers are continually facing new choices. Although the new options can make life easier there is no substitution for common sense and evaluating the changes for each particular situation. The wide variation in costs of production shows the importance of the individual situation. Product prices are more difficult to control and predict than production practices.
Figure 1
Number of Total Trips by Crop, 1996

Figure 2
Primary Tillage Practices, 1996
Figure 3
Number of Sprayer Trips by Crop, 1996

85% of soybean farmers made 0 trips
Figure 7
Yield and Returns by Tillage System and Crop, 1996

Figure 8
Average pounds of nutrients applied per acre
Figure 9
Soybean Weed Management Based on Row Widths, 1996

Figure 10
Soybean Yield and Return to Management Based on Row Widths, 1996
Figure 11
Yield and Fertilizer Use for Continuous Corn, 1996

Figure 12
Yield and Fertilizer Use for Rotated Corn, 1996
Figure 13
Energy Use by Category, 1996

Figure 14
Energy Balance by Crop, 1996