Cropping Practices Baseline Data, Crop Year 2002

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Executive Summary

This paper provides a summary description of the primary cropping practices in Iowa. Incorporating assumptions on input and output prices also allows for comparisons of costs and returns for the major crops of Iowa for the year 2000.

The major results are that there has been significant change in Iowa agricultural practices over the past decade with shifts toward labor saving technology (increasing use of no-till and genetically modified seeds). If the economic environment remains unchanged, continued change is likely to occur in the future.

Economic results are that there was a high degree of differences in costs and returns across different crops and practices in 2000. Even with large differences between the estimated high and low returns, average returns across cropping practices and seed types were quite similar. It could be concluded that much of the economic benefits of genetic modification flow to seed manufacturers.

The reader should note that the conclusions are based on input and output price assumptions. Also, the results of the survey are subject to a degree of error, primarily depending on the drawn sample and sample size. The size of the sample was much smaller in 2000 than for previous surveys discussed in this paper. Therefore, the results are subject to more possibility for error than in previous years.

Introduction

Rapid change is occurring in Iowa cropping practices. There hav been significant shifts in the practices followed in the last decade alone. Cultivation practices, the introduction of genetically modified crops, rapidly changing farm prices and other events have significantly affected returns to land, labor, and management.

This paper presents summary statistics and initial analysis from the 2000 cropping practices survey. The data were collected as an expansion of the USDA's Agricultural Resource Management Study. 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 from one of their fields. The data presented are for 29 fields with corn following corn (referred throughout as "continuous corn"); 149 fields with rotated corn; and 172 soybean fields.

In addition to the 2000 survey, selected comparisons and references will be made to similar surveys conducted in 1989, 1994, 1996, and 1998. The 1989 survey summary can be found in ISU Extension Publication FM1849. The 1994, 1996, and 1998 surveys are summarized in various USDA publications. Data from the 1996 and 1998 surveys were expanded in a similar manner to this survey.

Machinery Operations

The number of trips across a field varies greatly by crop, field condition, and operator preference. These factors appear to have combined to cause a significant change from 1996 in the average number of trips in soybean fields. In 1996, soybean fields were divided almost evenly between 6 or fewer trips and 7-10 trips. This shifted in 1998 and 2000, with 61 percent of fields reporting 6 or fewer trips and 39 percent of fields reporting 7-10 trips in 1998 and 56 percent of fields with 6 or fewer trips in 2000.

Trips across cornfields remained similar to previous years. The average number of trips for continuous cornfields was 6.9, ranging from 4 to 12. The average number of trips across rotated cornfields was 6.7 with a range of 3 to 12. The distribution of trips by crop is summarized in Figure 1.

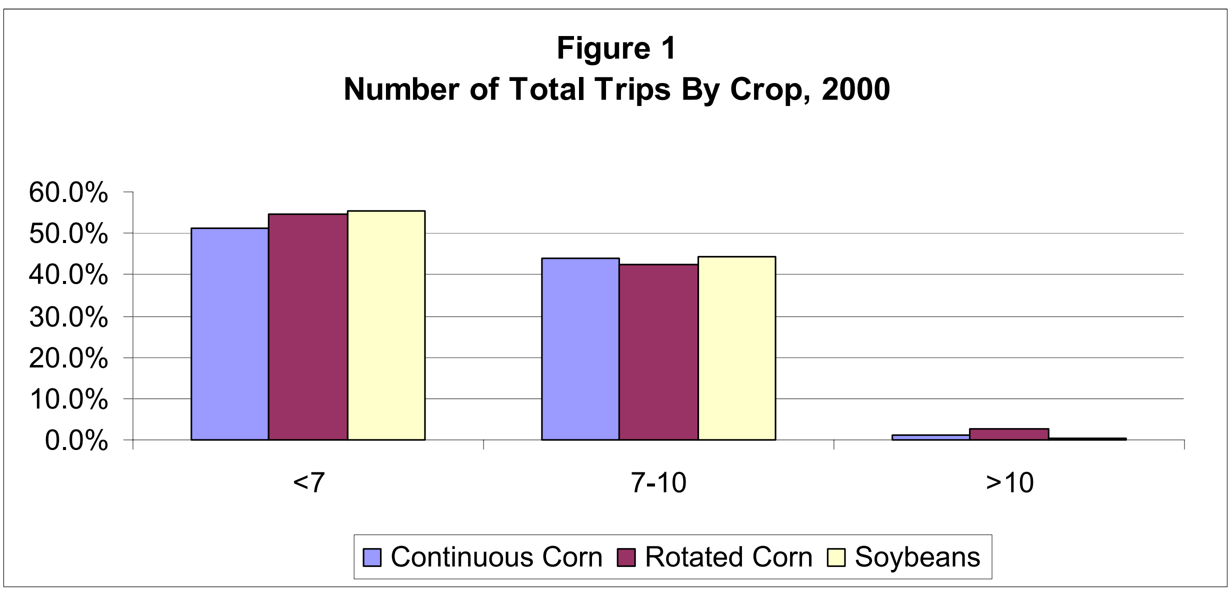
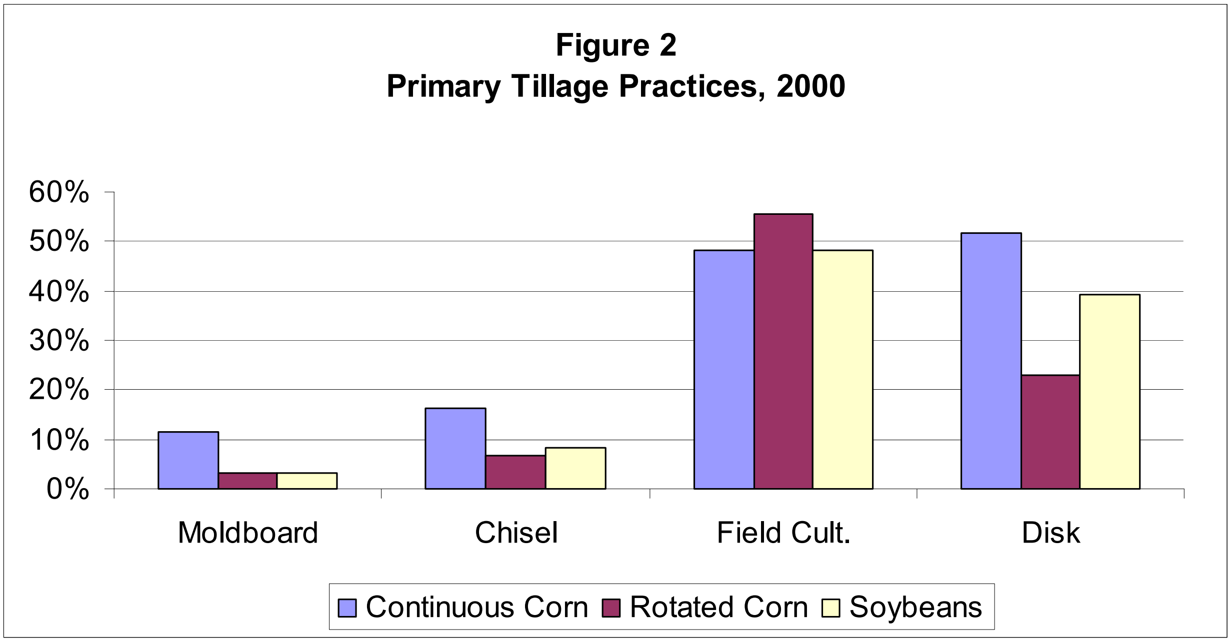
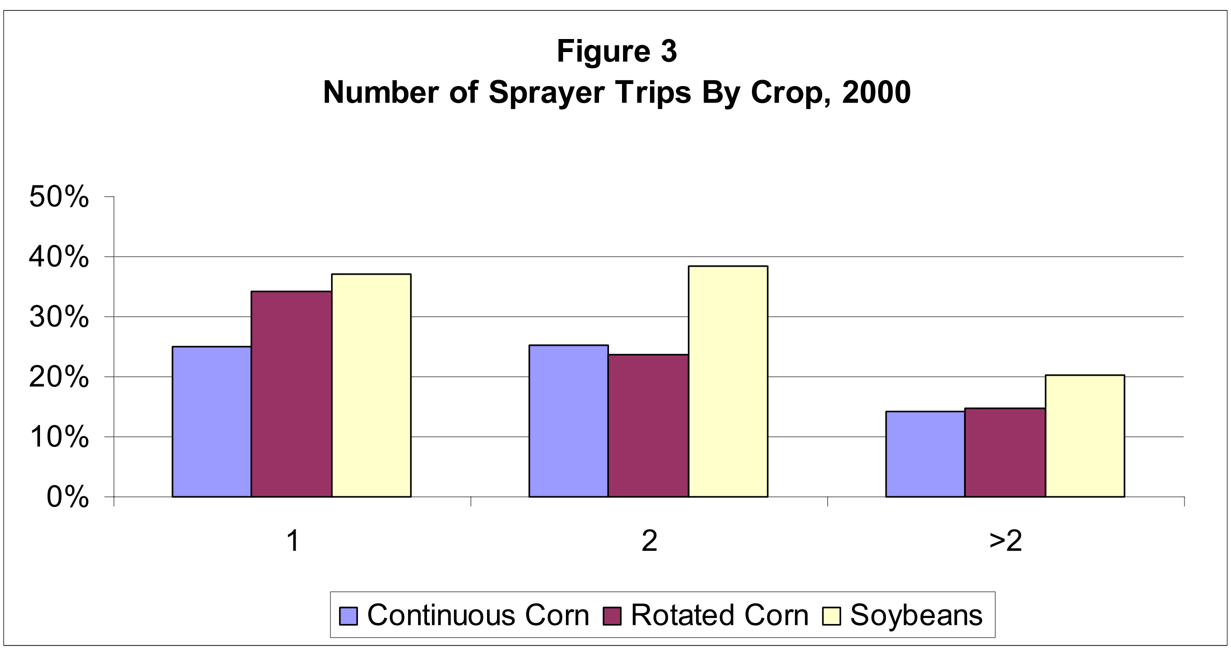
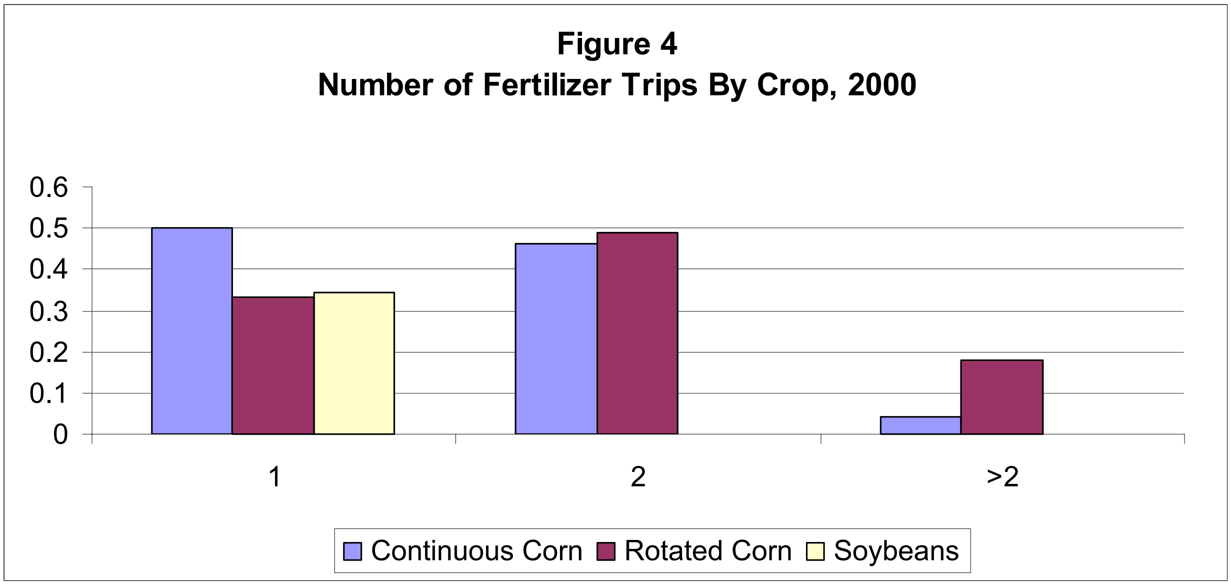


Figure 2 shows the percentage of acres by primary tillage implements.



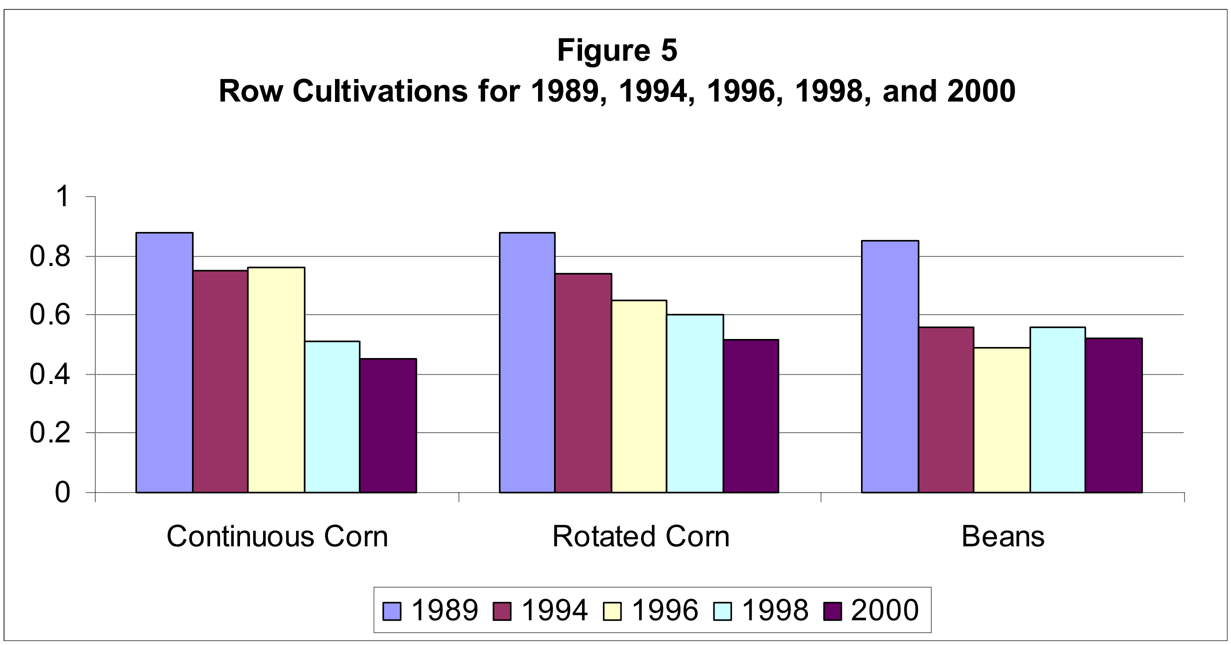
Figures 3 and 4 show the percentage of acres by the number of sprayer and fertilizer trips, respectively. There was a marked shift from 1996 toward more sprayer trips. Approximately 83% of all crop acres were sprayed at least once in 2000 with 57 percent of acres sprayed two or more times. As in past years, approximately 76 percent of soybean farmers reported no fertilizer trips.





Row Cultivation Continues Decrease

Row cultivation has decreased dramatically on corn acreage over the past seven years. This decrease is shown by crop in Figure 5. Row cultivation on continuous corn acres decreased significantly since 1996. Row cultivation of all crop acreage continued a steady decline.



The decrease of row cultivation in soybean acreage has not been as steady. Row cultivated soybean acreage in this sample actually shows a slight increase from 1996.

No-Till Use and Pre-plant Tillage Trips

Use of no-till on rotated corn acres increased significantly from 1996 to 2000; from 20 percent to nearly 33 percent. No-till was used on only 9.3 percent of continuous corn acres and 29.1 percent of the soybean acres. There were, of course, virtually no pre-plant tillage trips on no-till fields. Rotated corn and soybean pre-plant tillage trips were down substantially from 1996 at 1.35 and 1.25 respectively.

	Continuous Corn	Rotated Corn	Soybeans
No-Till (Percent of Acres)	9.3%	33%	29%
Pre-plant Trips	1.69	1.35	1.25

Pesticides

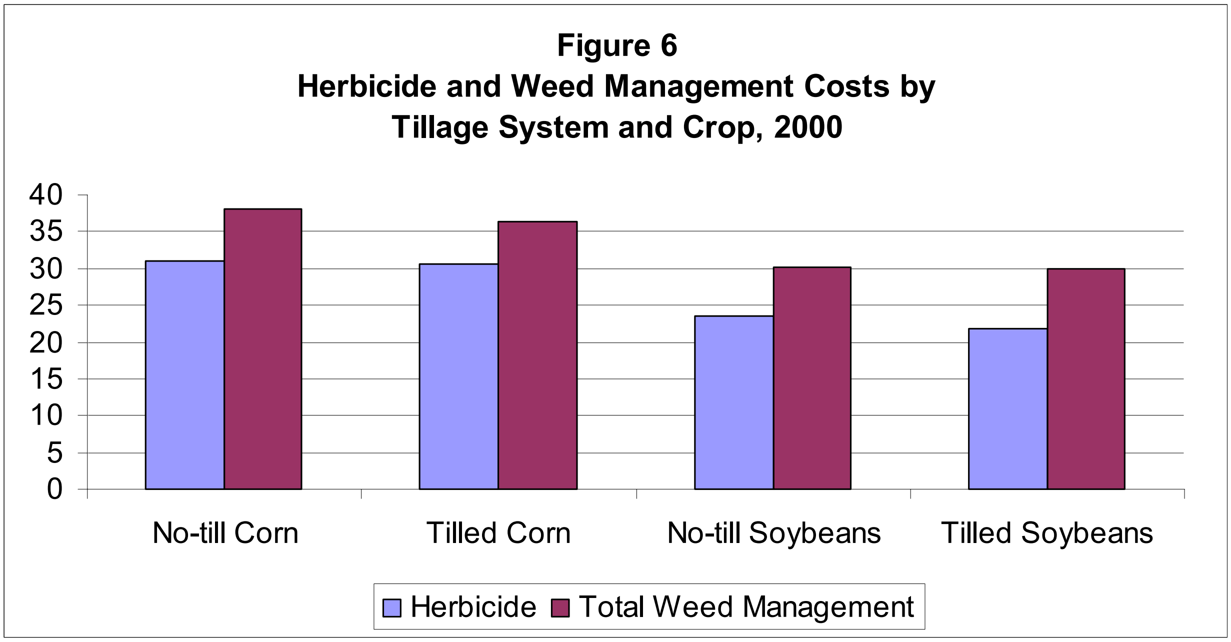
Virtually every field reported using herbicides. Herbicide costs were essentially identical for continuous corn ($32.17) and rotated corn ($31.83). Soybean herbicide expense has been similar to corn in past years; however more recently, average soybean herbicide expense has been lower than corn. This is due to a noticeable reduction in no-till and genetically modified (GM) soybean herbicide expense.

Herbicide Expense

Continuous Corn	$32.17
Rotated Corn	$31.83
Soybeans	$22.28

GM Soybeans Reduce No-Till Soybean Herbicide Costs

Figure 6 shows the average herbicide and total weed management costs by tillage and crop. As in past years, total weed management costs are very similar for tilled and no-till corn. However, Figure 6 illustrates a downward shift in soybean herbicide costs. This shift is due to the use of GM soybeans (56.4% of acres in 2000). This crop is examined in more detail later in this report, but the difference is worth noting here.



Slightly less than 63 percent of all no-till acres were planted with GM soybeans. The average herbicide cost was $6.17 per acre less for GM soybeans than non-GM modified beans. This explains how no-till beans had lower herbicide expenditures per acre than regular beans in 2000.

Other Pesticide Application Information

Pesticide application for both corn and soybeans is evenly divided between operator and custom applicators. For corn and soybeans, 61 percent of applied acres were by the operator and 38 percent by a custom applicator. Very few applications were made by an employee or other party.

Insecticides were applied on 17.6% of continuous corn acres at an average cost of $16.97 per treated acre. Only 16% of the rotated corn acres received an insecticide application at an average cost of $17.52 per treated acre. The percentage of all corn acres receiving an insecticide application declined from the roughly 20% reported in 1996 and 1998. Virtually none of soybean fields in the survey reported an insecticide application.

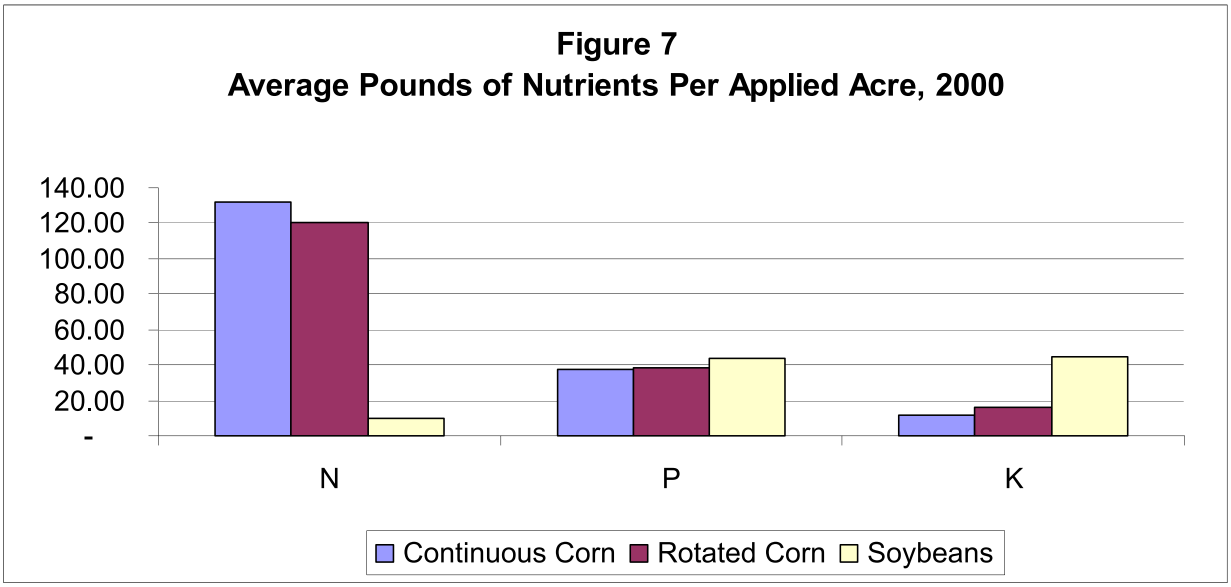
The use of Bt corn did not seem to affect the decision to apply insecticide as 15.8% of acres planted in Bt corn received an insecticide application. The differences in insecticide costs between Bt and Non-Bt seed are summarized in the table below. Bt corn is examined in further depth at the end of this paper.

Insecticide Costs, Bt and Non-Bt Seed

	Bt Seed	**Non-Bt Seed**
Insecticide Cost Per Treated Acre	$18.19	$14.11
Per Acre Average Cost of Insecticide, All Acres	$3.22	$2.66

Fertilizers

Average nutrient application is shown in Figure 7. Nitrogen was applied to continuous corn acreage at an average rate of 132 pounds per acre. The average nitrogen rate for rotated corn was 120 pounds per acre. Nitrogen was applied on more than 98 percent of corn acreage. Only 13 percent of soybean acres received commercial nitrogen. The average soybean rate was 10 pounds per applied acre.



Corn Commercial Fertilizer Use

	Continuous Corn	Rotated Corn
Pounds N	132.3	120.2
Pounds P	37.6	38.6
Pounds K	11.9	16.2

Slightly less than half of corn acreage, 37.3 percent of continuous corn acres and 42 percent of rotated corn acres used anhydrous ammonia fertilizer. This is a slight decrease from 1996, when more than half of corn acreage received anhydrous. Anhydrous accounted for 42 percent of the total commercial nitrogen applied to corn: 33 percent for continuous corn and 44 percent for rotated corn.

Anhydrous Ammonia Application

	Continuous Corn	Rotated Corn
Percent of Acres	37.3%	42.2%
Contribution to Total N	33.3%	43.8%

Phosphorous and potassium were applied to 75% of corn acres regardless of the rotation. Of the soybean respondents indicating applying some fertilizer, 84% reported applying either phosphorous or potassium.

Seed

The average seeding rate for corn was 28,494 kernels per acre. The rate for continuous corn was 29,627; the rate for rotated corn was 28,301. The average seed cost per acre was $29.63 for continuous corn and $28.30 for rotated corn.

The average seeding rate for soybeans was 1.14 bushels per acre at an average cost of $23.94. As in previous years, seeding rates and cost varied considerably depending on seed type and planting method.

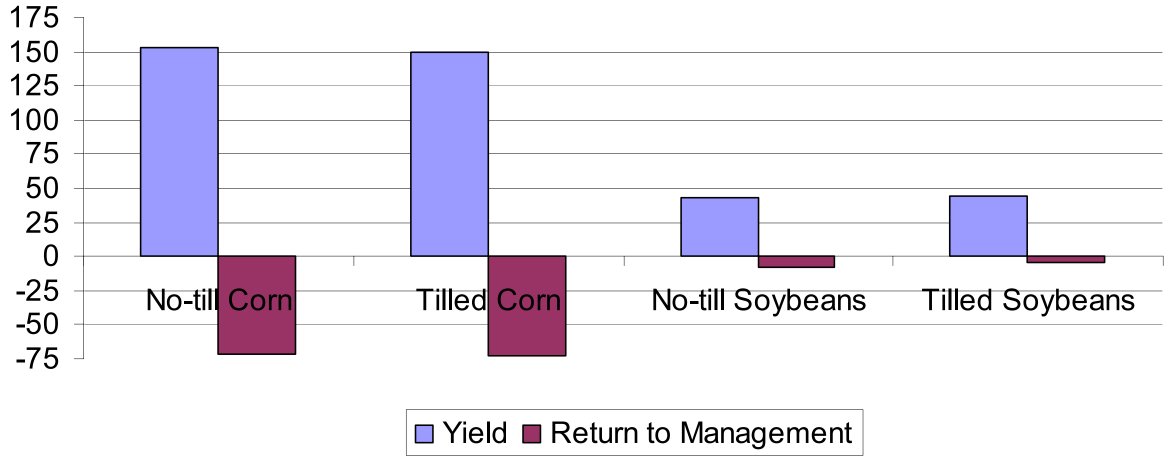
Yields and Returns

The average yields and returns for continuous corn, rotated corn, and soybeans are summarized in the table below and are illustrated in Figure 8.

Average Yields and Returns

Yield	**Continuous Corn**	**Rotated Corn**	**Soybeans**
Average	144.83	150.61	43.89
Minimum	0	0	15
Maximum	185	223	70
Return to Land, Labor, and Management	**Continuous Corn**	**Rotated Corn**	**Soybeans**
Average	$79.84	$85.93	111.15
Minimum	($162)	($201.97)	$5.67
Maximum	$190.48	$198.37	$203.26
Return to Management	**Continuous Corn**	**Rotated Corn**	**Soybeans**
Average	($76.11)	($70.12)	($19.97)
Minimum	($185.80)	($222.97)	($127.22)
Maximum	($1.67)	$38.12	$70.37

Figure 8
Yields and Returns by Tillage System and Crop, 2000



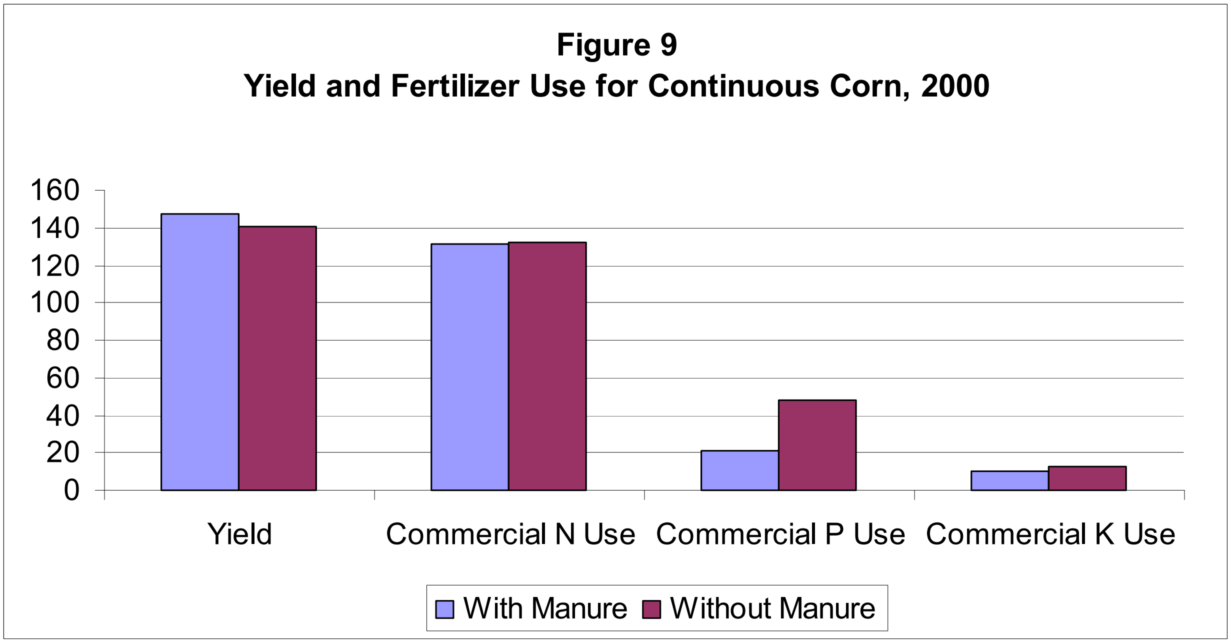
The costs for machinery operations and the price per pound for fertilizer were taken from the 2000 Iowa State Extension Service Estimated Costs of Crop Production. The total costs, without a land or labor charge, averaged $190.69 for continuous corn and ranged from $124.18 to $274.19. Total costs for rotated corn averaged $203.20 and ranged from $112.28 to $297.48. For soybeans, average costs without a land or labor charge were $146.97 and ranged from $76.87 to $237.27.

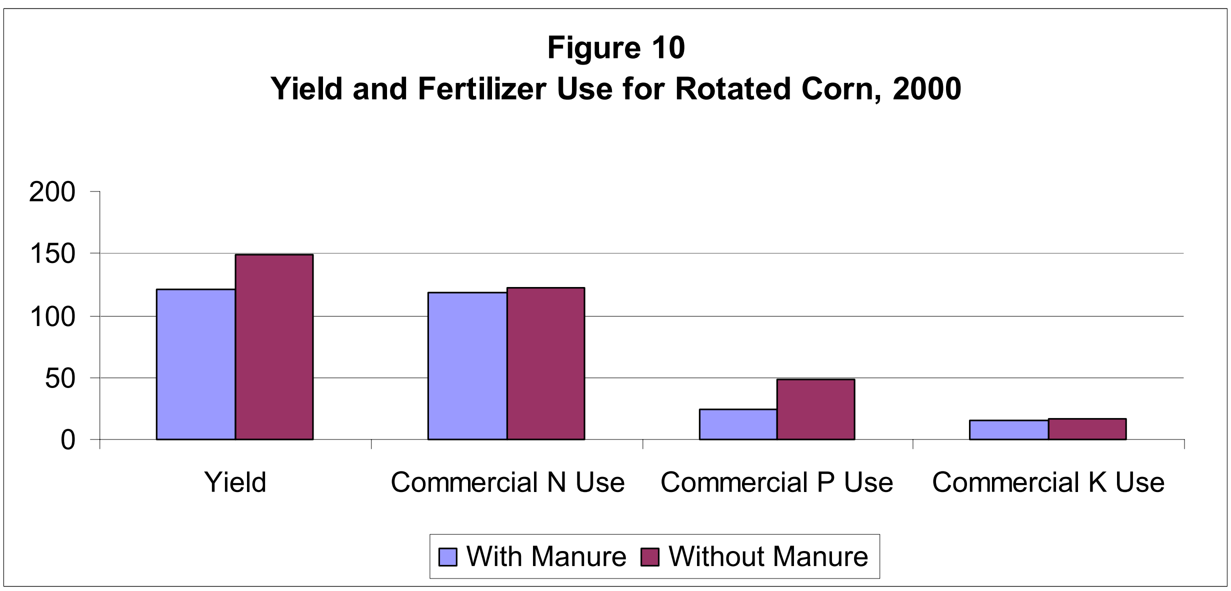
The average returns assume a corn price of $1.86 per bushel and a soybean price of $5.18 (both prices include a loan deficiency payment). A $12 per planted acre government payment was also added to calculated revenues. A charge of $0.91 per bushel of corn and $2.80 per bushel of soybeans were used to estimate land costs. The labor charges assumed were the average per acre charges reported in the 2000 Iowa State Extension Service Estimated Costs of Crop Production. Input prices were computed based on ISU budget estimates and reported industry averages.

Impacts of Manure

The proper use and handling of animal manure is one of the major issues facing animal agriculture. Manure was applied to only 13% of continuous corn acres and 20.7% of rotated corn acres.

Figures 9 and 10 show the yield and average commercial fertilizer use for continuous corn and rotated cornfields based on manure use. These data show that, across a wide selection of fields and cropping practices, Iowa farmers are taking into account a very small percentage of nutrient value of the manure. Further research from this and other studies is under way.





Labor Time

Total labor time per acre was calculated based on ISU labor time standards for various crop production practices. The average labor time per acre of corn was 1.15 hours (69 minutes). The average labor time per soybean acre was 0.96 hours (57.6 minutes).

Corn	Labor Time (hrs.)
Average	1.15
Rotated Corn	1.13
Continuous Corn	1.27
Bt Corn	1.14
Non Bt Corn	1.15

Soybeans	Labor Time (hrs.)
Average	0.96
Roundup Ready	0.87
Not RR	1.03

The time differences between various rotations and crop types resulted as would be expected. On average, the labor time for a continuous corn acre was 1.27 hours compared to 1.13 hours for an acre of rotated corn. There was almost no difference between the time spent on Bt compared to non-Bt corn. The average time spent for an acre of GMO soybeans was 0.87 hours compared to 1.03 hours for non-GMO soybeans.

Genetically Modified Soybeans

User Characteristics

More than 62% of the Iowa farmers surveyed planted genetically modified soybeans in 2000. Use appears to not be uniform across all types of tillage systems. Of conventional tillage systems 53% used GM seed while 82% of no-till systems reported using GM seed.

Farmers were also asked to respond why they chose to use genetically modified soybeans.

The following tables list the percentage of each response category for the total sample and by small and large acreage classification in 1998. Use appears more uniform across sizes of farms when evaluated based on soybean acreage compared to tillage system. Respondents were grouped into "small" planters (less than 200 soybean acres) and large planters (more than 200 soybean acres). Small planters accounted for 59% of respondents and large planters made up 41% of those planting GM soybeans.

Total Sample	
Increase yields through improved pest control	53%
Decrease pesticide input costs	27%
Increase planting flexibility	12%
Adopt more environmentally friendly practice	3%
Some other reason	6%

Large vs. Small Soybean Acreage Producers	Small (<200 Acres)	Large (200+ Acres)
Increase yields through improved pest control	60%	42%
Decrease pesticide input costs	24%	31%
Increase planting flexibility	10%	14%
Adopt more environmentally friendly practice	1%	5%
Some other reason	5%	8%

Generally, larger producers seem to be more concerned with utilizing genetically modified soybeans to decrease pesticide input costs and increase planting flexibility. All producers, however, planted genetically modified soybeans to increase yield.

While farmers may have planted GM soybeans to increase yield, increased yields were not reported. This was true across all observations and on both sizes of operations.

Average Soybean Yields, 1998

	GM	Non-GM
Average	49.26	51.21
Small Acreage Average	49.08	51.34
Large Acreage Average	49.43	51.09

Average Soybean Yields, 2000

	GM	Non-GM
Average Yield	43.39	45.01

Farmers utilizing GM soybeans in 2000 made an average of 0.96 preplant tillage trips across the field. Those not planting GM soybeans made an average of 1.54 trips. This may be explained by the percentage of farmers utilizing no-till and GM soybeans.

Planting Technique and GM Soybean Use, 2000

	GM Modified	Non-GM Modified
Used No-Till	53.3%	11%
Drilled Soybeans	5.2%	0%

Of the farmers planting GM soybeans, 53% used no-till while only 11% of those farmers planting non-GM beans utilized no-till. Farmers who planted GM beans were also much more likely to use drilling as a planting technique.

Weed Control Costs

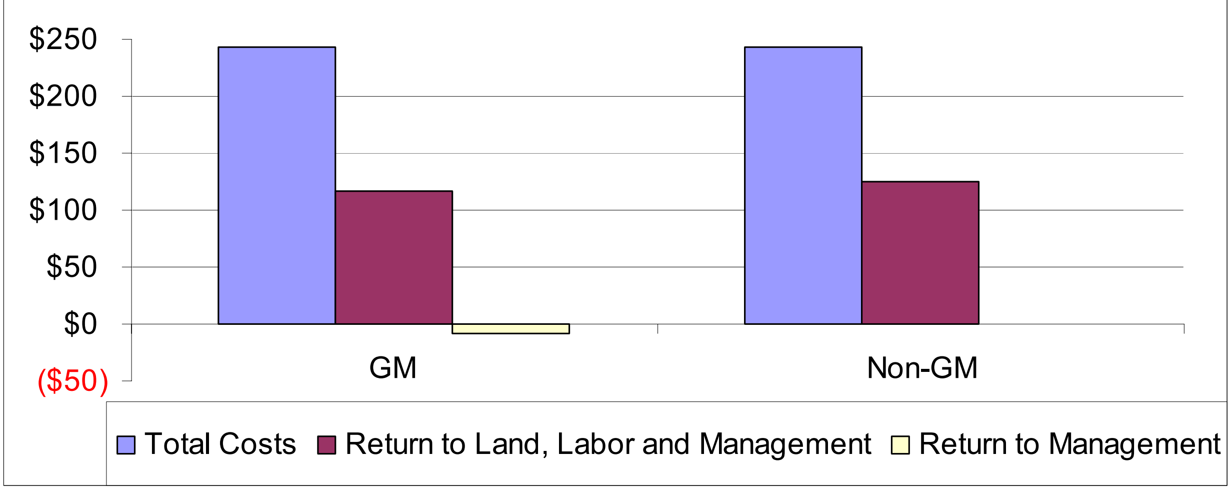
Farmers who utilized genetically modified soybeans experienced significant savings in herbicide costs, spending nearly 25% less than those employing regular beans. However, the extent of these savings seems to have been offset by the experience of decreased yields as evidenced by the similarities in returns to land, labor, and management.

Cost Comparisons (per acre)

Soybean Weed Control Costs	GM Modified	Non-GM
Herbicide Cost	$ 19.98	$ 26.15
Herbicide Application Cost	$ 4.37	$ 5.72
Row Cultivation Cost	$ 2.99	$ 2.91
Total Weed Control Costs Per Acre	$ 27.14	$ 34.80

Figure 11 shows Costs and Returns for GM and Non-GM Soybeans.

Figure 11
Costs and Returns for GM & Non-GM Soybeans, 2000



Cost and Return Comparisons (per acre)

Soybean Costs and Returns	GM Modified	Non-GM
Total Tillage and Planting Costs	$ 14.38	$ 16.95
Seed Cost per Acre	$ 25.56	$ 21.21
Total Costs	$ 242.94	$ 243.07
Return to Land, Labor and Management	$ 116.43	$ 125.06
Return to Management	$ (8.55)	$ (0.12)

Bt Corn

There are more genetic modifications available in the corn plant. In 2000, 26 percent of the corn planted in Iowa was Bt corn, 10 percent had some other genetic modification and the remaining 64 percent was not genetically modified as the term is used today. The remainder of this paper will only compare non-GMO with Bt corn.

The majority of fields (77 percent) were planted with Bt corn in 1998 to increase yields. About 7 percent of fields were planted in GM corn to decrease pesticide costs. The remaining fields planted in Bt corn were done so to increase planting flexibility, to adopt more environmentally friendly practices, or for some other reason.

Increased yields for Bt corn did occur in 2000. The average yield for Bt corn was 152.35 bushels/acre while the average yield for non-Bt corn was 148.97 bushels per acre.

Costs: **Insecticides**

The average cost for insecticide applied to corn acres runs somewhat counterintuitive for Bt corn. Insecticide was applied on 12% of fields utilizing Bt seed at an average cost of $17.56. Insecticide was applied on 18% of fields not using Bt seed at an average cost of $14.94.

	Bt Seed	Non-Bt Seed
Insecticide Cost Per Treated Acre	$14.43	$14.68
Per Acre Average Cost of Insecticide, All Acres	$1.62	$1.82

Other Costs

The most significant cost difference in Bt corn when compared to non-Bt seed is the seed cost per acre. Fields which were planted with Bt seed reported a slightly higher weed control cost per acre, as well as $5.02 more spent per acre in fertilizer costs.

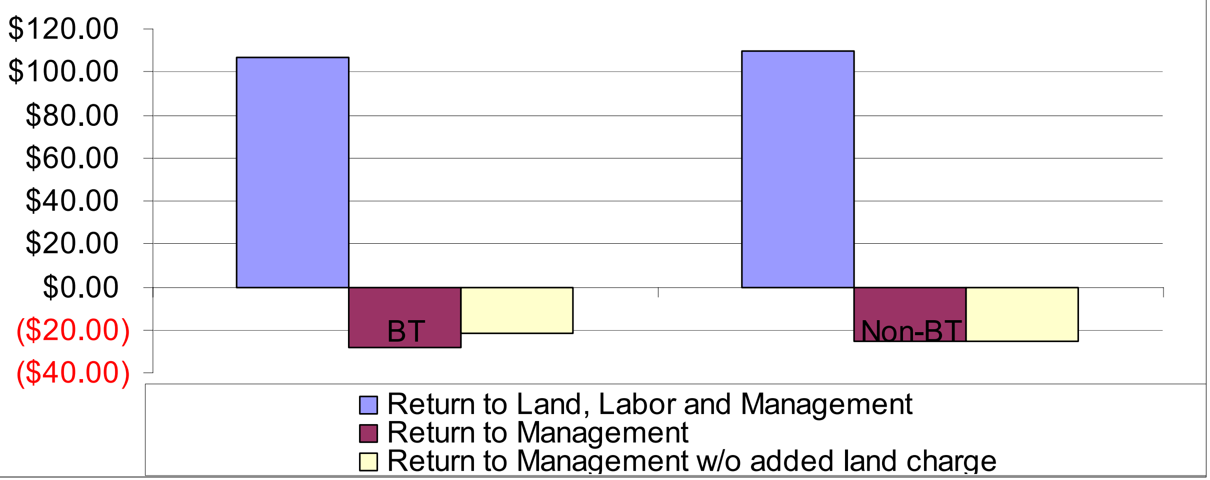
	Bt Seed	Non-Bt Seed
Seed Cost Per Acre	$33.05	$28.74
Weed Control Cost Per Acre	$38.10	$35.28
Fertilizer Costs Per Acre	$53.03	$48.67
Total Cost Per Acre	$207.25	$197.00

Returns

The lower return to management comes from the land charge being a function of yield per acre. However, if yields were assumed to be the same and no costs were assigned to the increase in Bt corn, return to management would be more accurately computed. If the higher yield is attributed to the cost of the Bt seed, not the quality of land, return to management slightly favors Bt corn, figure 12.

	Bt Seed	Non-Bt Seed
Return To Land, Labor, and Management	$106.59	$109.84
Return to Management	($28.28)	($25.02)
Return to Management w/o additional land charge	($21.85)	($25.02)

Figure 12
Returns for BT and Non-BT Corn, 2000



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. Introduction and widespread use of genetically modified crops is the most noticeable shift from past surveys.

With the advent of such new technology, Iowa farmers are continually facing new choices. Although the new options can often make production easier and more time efficient, each operator should continually evaluate the needs and goals of their situation and choose a technology appropriate to their situation.

Economic results are that there was a high degree of differences in costs and returns across different crops and practices in 2000. Even with large differences between the estimated high and low returns, average returns across cropping practices and seed types were quite similar. It could be concluded that much of the economic benefits of genetic modification flow to seed manufacturers.

Low returns from 2000 and the current commodity market show that product prices are more difficult to control and predict than production practices. Careful selection of production practices, however, can contribute to helping producers craft their production and marketing situation to the often volatile climate in which they operate.