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PROJECTED AND HISTORICAL CROP RETURNS: KEEP SOYBEANS IN 2004

Recently the wisdom of growing soybeans in Illinois has been questioned. In 2003, many Illinois farms experienced above average corn yields and below average soybean yields, leading to much higher returns for corn than for soybeans. In the long-run, soybean prices may decline relative to corn prices because of increased soybean production in South America. In September 2002, we suggested that planning prices for 2003 harvest-time supported planting more corn and wheat and less soybeans (see "Crop Rotations in 2003: More Corn and Wheat". *Illinois Farm Economics: Facts and Opinions.* September 23, 2002).

While long-run conditions may favor growing more corn and fewer soybeans in Illinois, planning prices for 2004 harvest-time do not suggest shifting more acres to corn, particularly for northern and southern Illinois. This conclusion is reached based on five-year average yields and prices of $2.25 per bu. for corn and $5.70 for soybeans. Moreover, a switch to more corn may increase return variability. Hence, shifting to more corn may increase risk.

Crop Revenue less Variable Costs

These issues are examined for northern, central and southern Illinois by calculating crop revenue less variable costs (CRLVC) for corn, soybeans, and wheat. CRLVCs are used in comparisons because this returns measure includes all major items that may vary with differences in plantings to crops. Crop revenue equals yield times effective price, where the effective price is the market price plus loan deficiency payments. Variable costs include fertilizer; seed; pesticides; drying and storage; and machinery repair, fuel, and hire.

Historical CRLVCs are reported for 1990 through 2003. For corn and soybeans, CRLVCs are calculated using data from Illinois Farm Business Farm Management (FBFM) records. CRLVCs for 2003 are preliminary as not all data necessary to calculate these figures have been processed by FBFM. Estimates for 2003 are based on U.S.D.A. yield estimates, along with University of Illinois price estimates of $2.25, $7.00, and $3.40 per bu for corn, soybeans, and wheat. A more detailed breakdown of historical CRLVCs is available in a Microsoft Excel spreadsheet that can be downloaded from *farmdoc* (www.farmdoc.uiuc.edu/manage/newsletters/fefo03_19/fefo03_19.html). For wheat, CRLVCs are calculated using costs in University of Illinois budgets, yields reported by the National Agricultural Statistical Service, and prices reported by the U.S. Department of Agriculture.

Projections for 2004 also are given. These projections are based on five-year average yields and commodity prices of $2.25 for corn, $5.70 for soybeans, and $3.40 for wheat. These prices are determined by subtracting basis from prices for Chicago Board of Trade futures contracts (December

2004 contract for corn, November 2004 contract for soybeans, and July 2004 contract for wheat). Projected budgets for corn and soybeans are available at *farmdoc* (http://www.farmdoc.uiuc.edu/manage/enterprise_cost/crop_revenue_less_variable_cost.html).

CRLVCs are reported for corn, soybeans, and wheat. Given that corn usually is preceded by soybeans on most Illinois farms, the historical "corn" series reported in the following sections most closely represents a "corn following soybeans" situation. A corn following corn budget also is used to calculate returns from different rotations by making two adjustements to the corn series: 1) corn yields are reduced by 10 bu. and 2) variable costs are increased by $5 per acre.

Also reported are CRLVCs for two rotations in each region. For northern and central Illinois, the rotations are ½ corn – ½ soybeans and 2/3 corn – 1/3 soybeans. CRLVCs for the ½ corn – ½ soybeans rotation are the average of corn and soybeans CRLVCs. CRLVCs for the 2/3 corn – 1/3 soybeans rotation is the average of "corn following soybean", "corn following corn", and soybeans. For southern Illinois, CRLVCs are given for a ½ corn – ½ soybeans rotation and a corn – soybeans – wheat rotation. CRLVCs for the corn – soybeans – wheat rotation equal the average of the CRLVCs for corn, soybeans, and wheat.

Northern Illinois

Yields for 2003 are estimated at 167 bu for corn, 37 bu for soybeans, and 72 bu for wheat (see Table 1). In 2003, corn yields are much higher than average, soybean yields are below average, and wheat yields are above average. The 2003 wheat yield is the highest yield of all yields between 1990 and 2003.

CRLVCs in 2003 are $193 per acre for corn, $147 per acre for soybeans, and $165 per acre for wheat (see Table 1). In 2003, corn's CRLVC is $46 per acre higher than soybean's CRLVC. Corn's CRLVC exceeded soybeans' CRLVC by a larger amount only in one year: $136 in 1996. In 2003, wheat's CRLVC exceeded soybean's CRLVC. Wheat's CRLVCs exceeded corn or soybeans' CRLVCs in only two years: 1995 and 2003.

Overall, relative CRLVCs in 2003 differ from historical averages between 1990 through 2003. Between 1990 and 2003, the average corn CRLVC ($193 per acre) is only slightly higher than the average soybean CRLVC ($186 per acre). During the same period, average wheat CRLVC ($105 per acre) is significantly below CRLVCs for corn and soybeans.

Projections for 2004 place corn's CRLVC at $175, soybeans' at $162, and wheat's at $141 (see Table 1). The above CRLVC for corn is based on corn following soybeans. The CRLVC for corn following corn is $148. These CRLVCs suggest that soybeans are more profitable than corn following corn. As a result, the projected CRLVC for the 1/2 corn – 1/2 soybeans rotation ($169 per acre) is higher than the CRLVC for the 2/3 corn – 1/3 soybeans rotation ($162 per acre) (see Table 1).

Between 1990 and 2003, the 1/2 corn – 1/2 soybeans rotation averaged $190 CRLVC, $9 more than the $181 per acre returns for the 2/3 corn – 1/3 soybeans rotation (see Table 1). From a historical return context, the 1/2 corn – 1/2 soybeans rotation has less variability in returns than the 2/3 corn – 1/3 soybean rotation. Between 1990 and 2003, the range from the lowest to highest return is $134 per acre for the 1/2 corn – 1/2 soybeans rotation compared to $158 per acre for the 2/3 corn – 1/3 soybeans rotation. This suggests that adding more corn to the rotation increases risks.

Table 1. Yields and Crop Revenue Less Variable Costs, Northern Illinois, Illinois Farm Business Farm Management, 1990 -- 2003 Actual and 2004 Forecast.

Year	Yields			Crop Revenue less Variable Costs[3]				
	Corn[1]	Soybeans[1]	Wheat[2]	Corn[4]	Soybeans[4]	Wheat[5]	1/2 Corn 1/2 Beans[6]	2/3 Corn 1/3 Beans[7]
	------- (bu. per acre) ---------			---------- ($ per acre) --------			--- ($ per acre) ---	
1990	135	47	59	$178	$199	$98	$189	$175
1991	107	40	42	118	152	48	135	120
1992	152	47	42	212	186	77	199	194
1993	128	47	38	134	198	44	166	146
1994	177	53	65	285	246	134	266	262
1995	127	45	67	144	164	192	154	141
1996	148	42	40	337	201	91	269	278
1997	142	50	61	217	276	117	247	226
1998	164	53	60	186	180	75	183	175
1999	155	50	69	174	182	101	178	168
2000	156	46	62	182	156	77	169	164
2001	159	48	72	158	161	122	160	150
2002	156	50	65	190	153	124	172	168
2003P[8]	167	37	72	193	147	165	170	168
Average	148	47	58	$193	$186	$105	$190	$181
Range[9]	70	16	34	$219	$129	$148	$134	$158
2004F[10]	160	49	68	$175	$162	$141	$169	$162

[1] Data from grain farms enrolled in Illinois Farm Business Farm Management (FBFM).

[2] Data from National Agricultural Statistical Service, U.S. Department of Agriculture

[3] Crop revenue equals yield times (actual price plus loan deficiency payments). Crop costs include fertilizer; seed; pesticides; drying ar storage; machinery repairs, fuel, and hire.

[4] Data taken from Illinois Farm Business Farm Management. A spreadsheet with data is available at www.farmdoc.uiuc.edu/manage/newsletters/fefo03)19/fefo03_19.html.

[5] Constructed from University of Illinois budgets.

[6] Equals average of corn crop revenue less crop costs for corn and soybeans.

[7] Equals average returns from corn following soybeans, corn following corn, and soybeans. Corn following soybean series equals the "corn" series in the fifth column. A corn following corn series was constructed by adjusting the "corn" series in column five. Adjustme were (1) corn yields were adjusted down by 10 bu. and costs increased by $5 per acre.

[8] Preliminary numbers.

[9] Range equals high value minus low value.

[10] Forecast based on a $2.25 corn price, a $5.70 soybean price, and a $3.20 wheat price. More detailed forecasts are provided at http://www.farmdoc.uiuc.edu/manage/enterprise_cost/crop_revenue_less_variable_cost.html

Central Illinois

Estimated yields for 2003 are 190 bu for corn, 38 bu for soybeans, and 72 bu for wheat (see Table 2). Both the corn and wheat yields are record-setting highs. The soybean yield is below average.

Corn's CRLVC for 2003 ($252 per acre) is considerably higher than soybean's CRLVC ($158 per acre). The $94 difference between the corn and soybean CRLVC is exceeded only once between 1990 and 2003 ($121 per acre in 1996). In 2003, wheat's CRLVC ($165 per acre) exceeded soybeans' CRLVC. This is the only year between 1990 and 2003 when wheat's CRLVCs exceeded CRLVCs for corn or soybeans.

Table 2. Yields and Crop Revenue Less Variable Costs, Central Illinois, Illinois Farm Business Farm Management, 1990 -- 2003 Actual and 2004 Forecast.

Year	Yields			Crop Revenue less Variable Costs[3]				
	Corn[1]	Soybeans[1]	Wheat[2]	Corn[4]	Soybeans[4]	Wheat[5]	1/2 Corn 1/2 Beans[6]	2/3 Corn 1/3 Beans[7]
	------- (bu. per acre) ---------			---------- ($ per acre) --------			--- ($ per acre) ---	
1990	149	47	58	$209	$193	96	$201	$194
1991	131	46	41	174	182	45	178	167
1992	176	49	51	277	196	106	237	240
1993	151	49	45	186	204	63	195	183
1994	182	52	60	306	248	118	277	277
1995	128	44	53	143	158	137	151	139
1996	161	48	42	365	244	99	305	312
1997	148	49	65	240	268	129	254	238
1998	152	49	59	167	169	72	168	159
1999	166	52	68	205	197	99	201	193
2000	165	49	66	206	173	87	190	186
2001	168	50	66	181	177	105	179	171
2002	161	50	60	203	156	109	180	178
2003P[8]	190	38	72	252	158	165	205	212
Average	159	48	58	$222	$195	$102	$209	$204
Range[9]	62	14	31	$222	$112	$120	$154	$173
2004F[10]	170	49	66	$205	$162	$135	$183	$181

Footnotes are shown at the end of Table 1.

Projected 2004 CRLVCs suggest that corn will be more profitable than soybeans or wheat. Corn's projected CRLVC for 2004 is $205 per acre compared to $162 per acre for soybeans (see Table 2). Wheat's CRLVC is $135 per acre. The $205 CRLVC for corn is based on the preceding crop being soybeans. The estimated CRLVC for corn following corn is $177. This suggests that planting more corn in central Illinois may be more profitable than planting soybeans.

In the long-run, however, planting more corn after corn may not be advisable. Planting more corn after corn means that in the following year less corn after soybeans will be planted, causing a lower corn after corn CRLVC ($177 per acre) to be substituted for a higher corn following soybeans CRLVC ($205 per acre) on some of the acres. As a result, rotational CRLVCs depend on the percentage of plantings in the preceding year. For example, a 2/3 corn – 1/3 soybeans split is planted in a year following a ½ corn – ½ soybeans split, the estimated CRLVC for the split is $186 per acre ($205 corn following soybeans CRLVC x ½ the acres + $162 soybean CRLVC x 1/3 of the acres + $177 corn following corn CRLVC x 1/6 of the acres). A 2/3 corn – 1/3 soybeans CRLVC is lower if the preceding crop is divided 2/3 corn – 1/3 soybeans. In this case the CRLVC is $181 per acre ($205 corn following soybeans CRLVC x 1/3 the acres + $162 soybean CRLVC x 1/3 the acres + $177 corn following corn CRLVC x 1/3 the acres).

The CRLVCs for the rotations in the tables are based on the long-run rotations in that the preceding year's crop is divided the same as the current year's crop. For central Illinois, the projected 2004 CRLVC for 2/3 corn – 1/3 soybeans ($181 per acre) is below the CRLVC for ½ corn and ½ soybeans ($183 per acre). This occurs even though the projected CRLVC for corn following corn is above the CRLVC for soybeans because the rotation includes less corn following soybeans.

Between 1990 and 2003, the ½ corn – ½ soybeans rotation has had less variability than the 2/3 corn – 1/3 soybeans rotation. The range in CRLVC between 1990 through 2003 is $154 per acre for the ½ corn – ½ soybeans rotation compared to $173 per acre for the 2/3 corn – 1/3 soybeans rotation. This suggests that increasing the percentage of corn in the rotation increases risk.

Southern Illinois

Estimated yields for 2003 are 128 bu for corn, 42 bu for soybeans, and 62 bu. for wheat (see Table 3). In 2003, corn and soybean yields are close to the five-year averages. Wheat yield in 2003 is the highest of all yields between 1990 and 2003.

In 2003, CRLVCs are highest for soybeans ($180 per acre) followed by wheat ($131 per acre) followed by corn ($113 per acre). Between 1990 and 2003, soybeans averaged the highest CRLVC ($144 per acre) followed by corn ($140 per acre) followed by wheat ($81 per acre)

Projections for 2004 again place soybeans as the most profitable crop in southern Illinois. The 2004 CRLVC projections have soybeans at $117 per acre, followed by corn at $103 per acre, followed by wheat at $96 per acre. The wheat CRLVC does not include a return for double-crop soybeans. Inclusion of double-crop soybeans causes wheat to look more attractive as a cropping alternative.

A comparison of a ½ corn – ½ soybeans rotation to a corn – soybeans – wheat rotation is given in Table 3. Projections for 2004 CRLVC indicate that the ½ corn – ½ soybeans rotation ($110 per acre) is likely to be slightly more profitable than the corn – soybeans – wheat rotation ($105 per acre). Again, however, wheat does not include a return for double-crop soybeans that may follow wheat.

Over time, the ½ corn – ½ soybeans rotation has exhibited more variability in returns than the corn – soybeans – wheat rotation. The range from the lowest to highest CRLVC for the ½ corn – ½ soybeans is $129 per acre compared to $98 per acre for the corn – soybeans – wheat rotation (see Table 3). This suggests that adding wheat to the rotation reduces risk.

Summary

Projected returns from corn, soybeans, and wheat for northern, central, and southern Illinois do not suggest large shifts away from soybeans to corn. For northern Illinois, a ½ corn – ½ soybeans rotation is projected to be the most profitable. For central Illinois, planting corn following corn may increase profits; however, there may be long-run reductions in returns due to increasing the percentage of corn in the rotation. For southern Illinois, soybeans are projected to more profitable than corn and wheat with double-crop soybeans is an attractive alternative. The above projections are based on five-year average yields and prices indicated by harvest-time futures contracts. Changes in either relative yields or relative prices will change the relative returns of the above crops.

Including higher percentages of corn in a rotation is likely to increase the variability of returns. If more corn is included in the rotation, it would be prudent to consider countering this increase in risk by increasing crop insurance coverage or by increasing use of preharvest hedging.

The author would like to acknowledge that data used in this study comes from the local Farm Business Farm Management (FBFM) Associations across the State of Illinois. Without their cooperation, information as comprehensive and accurate as this would not be available for educational purposes. FBFM, which consists of 6,000 plus farmers and 62 professional field staff, is a not-for-profit

organization available to all farm operators in Illinois. FBFM field staff provides on-farm counsel with computerized recordkeeping, farm financial management, business entity planning and income tax management. For more information, please contact the State FBFM Office located at the University of Illinois Department of Agricultural and Consumer Economics at 217-333-5511 or visit the FBFM website at www.fbfm.org.

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Table 3. Yields and Crop Revenue Less Variable Costs, Southern Illinois, Illinois Farm Business Farm Management, 1990 -- 2003 Actual and 2004 Forecast.

Year	Yields			Crop Revenue less Variable Costs[3]				
	Corn[1]	Soybeans[1]	Wheat[2]	Corn[4]	Soybeans[4]	Wheat[5]	1/2 Corn 1/2 Beans[6]	Corn/Beans Wheat[7]
	------- (bu. per acre) ---------			---------- ($ per acre) --------			--- ($ per acre) ---	
1990	112	35	44	$125	$119	$57	$122	$100
1991	95	37	30	92	136	17	114	82
1992	152	44	55	215	166	119	191	167
1993	131	41	45	146	154	63	150	121
1994	132	43	55	187	181	103	184	157
1995	107	36	48	97	103	118	100	106
1996	115	38	37	233	167	78	200	159
1997	111	42	61	143	214	117	179	158
1998	121	39	46	108	113	40	111	87
1999	115	37	59	107	112	76	110	98
2000	149	45	57	176	150	65	163	130
2001	151	45	59	149	145	86	147	127
2002	97	34	46	65	76	66	71	69
2003P[8]	128	42	62	113	180	131	147	141
Average	123	40	50	$140	$144	$81	$142	$122
Range[9]	57	11	32	$168	$138	$114	$129	$98
2004F[10]	128	41	54	$103	$117	$96	$110	$105

All footnotes other than 7 are shown at the end of Table 1.

[7] Equals the averages of returns from corn, soybeans, and wheat