FAIR, PostFAIR, and NoFAIR:
A Comparison of Cropping Alternatives for the Southern Great Plains

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Abstract

The Federal Agriculture Improvement and Reform Act of 1996 was promoted as legislation that would enable and encourage farmers to base planting decisions on market incentives rather than commodity programs. Data from a designed experiment are used to compare the economics of three cropping systems for alternative commodity programs.

Introduction

Diversification of cropping systems can be achieved by rotation of different species over years within a given field. It has been hypothesized, and demonstrated in some locations, that diversity provided by crop rotations may help manage, or reduce, weed, insect, pathogen, and nematode problems. Some view the genetic diversity that results from crop rotations as an important means to sustainable crop production.

While the potential agronomic, environmental, and aesthetic benefits of species diversification and crop rotation have been espoused, the reality is that the vast majority of cropland in the rain fed region of the southern Great Plains is seeded to winter wheat and most of that land is in continuous wheat production. The lack of diversity is further exaggerated by the fact that for the 2001-2002 season, more than 45% of the wheat acreage in Oklahoma, and 54% of the acres in the North Central region of the state were seeded to a single variety (Oklahoma Agricultural Statistics Service, 2002b). The potential for a widespread yield disaster is troubling.

Federal government programs have influenced U.S. crop production since the 1930's (Epplin). The vast majority of cropland in the rain fed region of the southern Great Plains is seeded to continuous monocrop winter wheat and over time has become wheat program base acres. For many years prior to 1996, the federal wheat commodity program provided incentives for producers to grow wheat and disincentives to diversify. Prior to 1996, to maintain eligibility for program participation and federal subsidies, producers were not permitted to plant crops other than wheat on wheat base acres. In 1975 more than 96% of the cropland in Garfield County, Oklahoma was seeded to winter wheat. By 1995, the proportion seeded to wheat, excluding land in the Conservation Reserve Program, had increased to more than 99% (Table 1) (Oklahoma Agricultural Statistics Service, 2002a; U.S. Department of Agriculture).

The Federal Agriculture Improvement and Reform (FAIR) act of 1996 was promoted as legislation that would enable farmers to base planting decisions on market incentives rather than commodity programs. The incentive to build and maintain wheat program base acres was removed, thus allowing farmers the opportunity to seed wheat base acres to crops other than wheat without jeopardizing program payments. In addition, the requirement for conservation compliance, and the development of weed, pest, and pathogen problems resulting from the lack of diversity, provided justification to search for economically competitive and environmentally compatible alternatives to continuous monoculture winter wheat for the southern Great Plains. However, while farmers were free to try other crops, only a limited amount of historical data enabling the comparison of the economics of alternative crops and cropping systems for the region were available.

Table 1 includes estimates of the cropland acres of Garfield County, Oklahoma planted in 1995 and 2000. This enables a comparison of cropped acres prior to and after implementation of the 1996 legislation. The data show that in 1995, 410,000 acres were seeded to wheat in the County. By 2000, wheat acreage declined by 17%, to 340,000 acres. Acres seeded to soybeans and sorghum increased by almost 30,000. While the data are not precise, it is likely that most of the remaining 40,000 acres removed from wheat production, was not seeded to other crops, but used for pasture. In addition, the data suggest that most of the 8,000 acres that exited the Conservation Reserve Program (CRP) were retained in permanent pasture. Of the 425,000 acres that were cropped or in the CRP in 1995, the data suggest that by 2000, almost 60,000 acres, 14%, very likely was used for pasture.

The data suggest that farmers in Garfield County responded to the flexibility afforded by the 1996 legislation. While it is not clear from these data, it is likely that land marginally suited to produce winter wheat was returned to the production of pasture. Based upon changes in cropping patterns as reflected in Table 1, the two most likely crops, other than pasture, to be considered, as alternatives to wheat were soybeans and sorghum. Data are not available to compare the economics of sorghum in the region. However, data from a designed agronomic experiment that included both wheat and soybeans are available.

The objective of this study was to determine the economics of monoculture continuous winter wheat relative to the economics of two potential alternatives for the traditional wheat production region of the southern Great Plains. The two alternatives include continuous soybeans and a crop rotation that includes winter wheat and soybeans. The economics of the three systems are compared using (1) cash market prices (no FAIR), (2) market prices plus the effective loan deficiency payments of the Federal Agriculture Improvement and Reform Act (FAIR) of 1996, and (3) the expected price floors provided by the Farm Security and Rural Investment Act of 2002 (post FAIR).

Materials and Methods

Data were obtained from a study conducted from 1997 through 2000 at the North Central Research Station at Lahoma, OK, under rain fed conditions. Three cropping systems were included. Systems were continuous wheat, continuous soybeans, and a soybeans-wheat/soybeans two-year rotation. Continuous winter wheat was planted in mid-October, and harvested in June. Continuous soybeans were planted in May and harvested in November. For the soybeans-wheat/soybeans rotation, soybeans were planted in April and harvested in September; followed by winter wheat planted in October and harvested the following June; followed by doublecrop soybeans planted after wheat harvest, with soybean harvest in November.

Wheat and continuous soybeans were planted using conventional tillage. Conventional tillage operations consisted of disking, chiseling, and field cultivating. Doublecrop soybeans were sown using a no-till row crop planter. All yields were measured after threshing and drying to bring seed to uniform moisture content. Table 2 includes a listing of the field operations for each of the three systems. Mean yield across the four replications for each year are reported in Table 3.

A representative farm approach was used to estimate difference in costs and returns across the various systems including differences in machinery requirements and machinery ownership and operating costs (Kletke and Doye; Kletke and Sestak). Enterprise budgeting was used to determine revenues, costs, and net returns for each of the three systems, for each season, for each of the three market (program) situations. For the No FAIR situation, it was assumed that the producer would have received the cash market prices that prevailed in the region over the time period of the agronomic study, 1998-2000 (Oklahoma Market Report). This is an obvious simplification. Cash prices paid over the time period were not independent of the FAIR program that was in effect. For the FAIR situation, it was assumed that producers received the cash market prices plus the loan deficiency payments that were in effect from 1998-2000. Since the Agricultural Market Transition Act (AMTA) payments would have been the same independent of crop grown, they were not considered. For the Post FAIR situation the expected price floors provided by the Farm Security and Rural Investment Act of 2002 were applied to the actual cash market prices that prevailed in the region over the 1998-2000 time period. As with the AMTA payments, counter cyclical and direct payments were ignored. Effective prices used for budgeting are reported in Table 4. Base budgets for each of the three systems are included in Tables 5, 6, and 7.

Results and Discussion

Net returns for each system, year, and program scenario are reported in Table 8. Continuous wheat was the only system that had positive net returns for each year and for each program scenario. Under all program scenarios, both continuous soybeans and the soybeans-wheat/soybeans rotation outperformed continuous wheat in 1998 and 1999, but due to unfavorable weather conditions the soybeans-wheat/soybeans rotation achieved returns below tradition continuous wheat in 2000. In addition, net returns from the soybeans-wheat/soybeans rotation were higher than those for the continuous soybeans for all three years and under all program scenarios.

Under the No FAIR program, the soybeans-wheat/soybeans rotation, on average, earned $10 more per hectare than continuous wheat, and $14 more than continuous soybeans. In addition, continuous wheat slightly outperformed continuous soybeans under the No FAIR policy, resulting in part from the decline in soybean prices relative to the price of wheat (Table

3). As was the case under a No FAIR price program, average net returns for the soybeans-wheat/soybeans rotation under the FAIR program outperformed both the continuous soybeans and continuous wheat systems by $17 and $56 per hectare, respectively. However, under this policy, continuous soybeans outperformed traditional continuous wheat by $38 per hectare. This was so, because adding the LDP to the market price increased the price of soybeans above the price under the No FAIR policy (Table 3). Similar to the No FAIR and FAIR programs, average net returns for soybeans-wheat/soybeans outperformed both continuous soybeans and continuous wheat by $32 and $33 per hectare, respectively. Support prices for wheat under the Post FAIR program increased slightly, while at the same time support prices for soybeans declined (Table 3). As a result, traditional continuous wheat would have had higher average net returns than the continuous system under the expected Post FAIR program.

Stochastic dominance procedures were performed (Cochran and Raskin). Results of the stochastic dominance analysis are reported in Table 9. All three cropping systems are included in the first-degree stochastic dominance (FSD) efficient set for each program situation. Second-degree stochastic dominance (SSD) was also performed. Continuous soybeans are not included in the SSD efficient set under either the No FAIR or Post FAIR programs. Continuous soybeans are included in the FAIR SSD efficient set. The reduction in the loan rate of soybeans relative to that of wheat that occurred with implementation of the 2002 legislation has reduced the incentive to plant continuous soybeans in the region.

Stochastic dominance with respect to a function (SDRF) is a more discriminating efficiency criterion, which allows for greater flexibility in representing preference. SDRF orders uncertain choices for decision makers whose absolute risk aversion functions lie within specified lower and upper bounds. SDRF efficient sets for four ranges of risk preference are also reported in Table 9. The soybeans-wheat/soybeans system would be preferred by a risk seeking decision maker under all program scenarios.

However, for the risk neutral individual, the preferred cropping system depends on the program scenario. Under the No FAIR and Post FAIR programs, both the continuous wheat and the soybeans-wheat/soybeans systems were included in the decision maker's efficient set, but under the FAIR program scenario only the soybeans-wheat/soybeans system was included. On the other hand, a slightly risk averse decision maker would prefer the continuous wheat system under the No FAIR and Post FAIR program scenarios. Finally, a strongly risk averse decision maker would prefer the traditional continuous wheat system under all three program scenarios.

FAIR was promoted as legislation that would enable and encourage farmers to base planting decisions on market incentives rather than government programs. Since the loan deficiency payments remained coupled to production, it was possible for FAIR to distort market incentives. The results of this analysis suggest that for the region under study FAIR improved the economics of continuous soybeans relative to that of continuous wheat. However, the analysis also suggests that Farm Security and Rural Investment Act of 2002 has once again changed the relative economics.

Government programs based upon historical markets with payments coupled to production such as the loan deficiency payment stand the risk of distorting market incentives especially if technological advancements favor one crop over alternatives. In 1996 about two percent of the total US soybean acreage was seeded to herbicide-tolerant roundup-ready® soybeans, this proportion rose to more than 70 percent in 2001. Government policy did not change at the same rate.

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Table 1. Cropland Use in Garfield County, Oklahoma, 1995 and 2000 (acres).

	1995	2000	1995 - 2000 Change
Program Crops			
Wheat	410,000	340,000	-70,000
Oats	800	-	-800
Corn	-	1,500	1,500
Sorghum	1,400	22,000	20,600
Soybeans	500	9,500	9,000
Total of Program Crops	412,700	373,000	-39,700
Conservation Reserve	12,375	4,351	-8,024
Program Crops + CRP	425,075	377,351	-47,724
All Hay	36,000	24,000	-12,000
Crops + CRP + Hay	461,075	401,351	-59,724
Increase in Cropland Use for Pasture or Grazing		59,724	

Sources: Oklahoma Agricultural Statistics Service; U.S. Department of Agriculture.

Table 2. Chronology of Field Operations for the Three Alternative Cropping Systems.

Continuous Wheat (2-Growing Seasons)

Month	Field Operation
February	Topdress (33-0-0) @ 56 kg ha^{-1} (19 kg N ha^{-1})
March	Apply Herbicide (.04 L ha^{-1} Amber and 1.2 L ha^{-1} Rhonox)
June	Combine
July	Disk
September	Chisel
	Fertilize (82-0-0) @ 86 kg ha^{-1} (71 kg N ha^{-1})
	9" Sweep
October	Drill Wheat (Conventional @ 100 kg ha^{-1})
February	Topdress (33-0-0) @ 56 kg ha^{-1} (19 kg N ha^{-1})
March	Apply Herbicide (.04 L ha^{-1} Amber and 1.2 L ha^{-1} Rhonox)
June	Combine
July	Disk
September	Chisel
	Fertilize (82-0-0) @ 86 kg ha^{-1} (71 kg N ha^{-1})
	9" Sweep
October	Drill Wheat (Conventional @ 100 kg ha^{-1})

Continuous Soybeans (2-Growing Seasons)

Month	Field Operation
March	Disk
May	Do-All
June	Drill Roundup Ready Group 5 Soybeans (Conventional @ 52 kg ha^{-1})
	Apply Herbicide (Dual @ 1.5 L ha^{-1})
July	Apply Herbicide (Roundup @ 1.75 L ha^{-1})
November	Combine
March	Disk
May	Do-All
June	Drill Roundup Ready Group 5 Soybeans (Conventional @ 52 kg ha^{-1})
	Apply Herbicide (Dual @ 1.5 L ha^{-1})
July	Apply Herbicide (Roundup @ 1.75 L ha^{-1})
November	Combine

Soybeans-Wheat/Soybeans (2-Growing Seasons)

Month	Field Operation
March	Disk
April	Do-All
	Drill Early-Season Roundup Ready Group 4 Soybeans (Conventional @ 52 kg ha^{-1})
	Apply Herbicide (Roundup @ 1.75 L ha^{-1})
May	Apply Herbicide (Roundup @ 1.75 L ha^{-1})
September	Combine Early-Season Soybeans
	Disk
	Fertilize (82-0-0) @ 86 kg ha^{-1} (71 kg N ha^{-1})
	9" Sweep
October	Drill Wheat (Conventional @ 100 kg ha^{-1})
February	Topdress (33-0-0) @ 56 kg ha^{-1} (19 kg N ha^{-1})

Table 2. Cont.

March	Apply Herbicide (Express @ .02 L ha^{-1})
June	Combine Wheat
	Plant Full-Season Roundup Ready Group 5 Soybeans (No-Till @ 52 kg ha^{-1})
	Apply Herbicide (Roundup @ 1.75 L ha^{-1})
July	Apply Herbicide (Roundup @ 1.75 L ha^{-1})
November	Combine Full-Season Soybeans

Table 3. Yields by Cropping System for 1998, 1999, and 2000 (kg ha^{-1}).

Year	Continuous Soybeans	Continuous Wheat	Soybeans in Rotation	Doublecrop Soybeans	Wheat in Rotation
1998	2297	3493	3449	928	3458
1999	2528	3767	2320	1087	3755
2000	984	2869	1413	397	2787
Average	1936	3376	2394	804	3333

Table 4. Commodity Prices Over Years and Across Programs ($ kg^{-1}).

Year	Continuous Wheat	Continuous Soybean	Doublecrop Soybean	Wheat in Rotation
Cash (No FAIR) Market Prices				
1998	0.10	0.20	0.20	0.10
1999	0.09	0.17	0.16	0.09
2000	0.09	0.17	0.17	0.09
Cash (FAIR) plus LDP				
1998	0.10	0.21	0.21	0.10
1999	0.09	0.21	0.21	0.09
2000	0.09	0.21	0.21	0.09
Cash (Post FAIR) plus LDP				
1998	0.10	0.20	0.20	0.10
1999	0.10	0.19	0.19	0.10
2000	0.10	0.19	0.19	0.10

Table 5. Base Budget for Continuous Soybeans Production ($ ha^{-1}).

Item	Units	Price	Quantity	Value
Gross Receipts				
Soybeans	Kg	_______	________	________
Total Revenue	Ha			________
Operating Inputs‡				
Dual	L	27.00	1.46	39.43
Roundup	L	14.40	1.75	25.24
Custom Harvest	Ha	29.64	1.00	29.64
Custom Harvest	Kg	0.01	________	________
Custom Hauling	Kg	0.01	________	________
Total Operating Costs	Ha			________
Returns Above Total Operating Costs	Ha			________
Returns Above All Specified Costs	Ha			________§

‡ Costs for inputs that did not change across treatments, such as cost of seed and tillage operations are not included.
§ Returns above variable costs were averaged over three years.

Table 6. Base Budget for Continuous Wheat Production ($ ha^{-1}).

Item	Units	Price	Quantity	Value
Gross Receipts				
Wheat	Kg	________	________	________
Total Revenue	Ha			________
Operating Inputs‡				
Amber	L	338.18	0.04	13.85
Rhonox	L	76.01	0.07	5.56
Ammonium Nitrate	Kg	0.27	56.07	15.27
Anhydrous Ammonia	Kg	0.36	86.35	30.75
Fertilizer Spreader Rental	Ha	5.56	1.00	5.56
Custom Harvest	Ha	29.64	1.00	29.64
Custom Harvest	Kg	0.01	________	________
Custom Hauling	Kg	0.01	________	________
Total Operating Costs	Ha			________
Returns Above Total Operating Costs	Ha			________
Returns Above All Specified Costs	Ha			________§

‡ Costs for inputs that did not change across treatments, such as cost of seed and tillage operations are not included.
§ Returns above variable costs were averaged over three years.

Table 7. Base Budget for Soybeans-Wheat/Soybeans rotation ($ ha^{-1}).

Item	Units	Price	Quantity	Value
Gross Receipts				
Wheat	Kg			
Soybeans	Kg			
Total Revenue	Ha			
Operating Inputs‡				
Roundup	L	14.40	3.50	50.47
Express	L	769.71	0.01	7.03
Ammonium Nitrate	Kg	0.27	28.03	7.57
Anhydrous Ammonia	Kg	0.36	43.17	15.54
Fertilizer Spreader Rental	Ha	5.56	1.00	5.56
Custom Harvest Wheat	Ha	29.64	1.00	29.64
Custom Harvest Wheat	Kg	0.005		
Custom Harvest Soybeans	Ha	44.46	1.00	44.46
Custom Harvest Soybeans	Kg	0.004		
Custom Hauling	Kg	0.005		
Total Operating Costs	Ha			
Returns Above Total Operating Costs	Ha			
Returns Above All Specified Costs	Ha			§

‡ Costs for inputs that did not change across treatments, such as cost of seed and tillage operations are not included.

§ Returns above variable costs were averaged over three years.

Table 8. Net Returns to Land, Labor, and Management ($ ha^{-1} yr^{-1}).

System	Program	1998	1999	2000	Average
	No FAIR	208	161	-74	98
Continuous Soybeans	FAIR	225	270	-39	152
	Post FAIR	208	236	-52	131
	No FAIR	136	114	55	102
Continuous Wheat	FAIR	136	142	62	113
	Post FAIR	151	179	90	140
	No FAIR	275	130	-68	112
Soybeans-Wheat/Soybeans	FAIR	298	206	2	169
	Post FAIR	283	202	4	163

Table 9. Ranking Alternative Cropping Systems Using Stochastic Dominance

Method of Stochastic Dominance	No FAIR Efficient Set	FAIR Efficient Set	Post FAIR Efficient Set
First Degree	SB, WT, WS	WT, SB, WS	WT, SB, WS
Second Degree	WT, WS	WT, SB, WS	WT, WS
With respect to a function			
Risk Seeker (-.1125 to -.0145)	WS	WS	WS
Risk Neutral (-.0145 to .0145)	WT, WS	WS	WT, WS
Slight Risk Aversion (.0145 to .0550)	WT	WT, WS	WT
Strong Risk Aversion (.0550 to .1500)	WT	WT	WT

SB is continuous soybeans
WT is continuous wheat
WS is soybeans-wheat/soybeans in rotation
Pratt-Arrow risk aversion coefficient intervals are taken from Raskin and Cochran (1986)